THE

Malayan Agricultural Journal

MAY 1930.

MESSAGE TO THE MALAYAN AGRICULTURAL JOURNAL

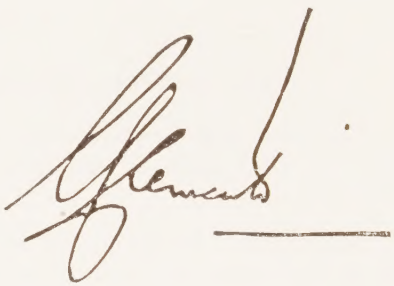
FROM

His Excellency, Sir Cecil Clementi, K.C.M.G.,

Governor and Commander-in-Chief of the Straits Settlements and High Commissioner for the Malay States.

His Majesty the King, on the occasion of his visit to the International Institute of Agriculture at Rome in 1923, said of agriculture that it " provides " not only the actual necessities of life, but a firm foundation of social and " political stability, while ensuring to a thrifty and industrious population a " life under the healthiest of natural conditions." The aim of the King's Government in all parts of His Majesty's Dominions is the welfare of his subjects—men, women and children—and the creation of happy, healthy and prosperous homes. Now, in order that this aim may be attained, there must in the first place be provision for the actual necessities of life, and foremost among these is food. The staple food of the great mass of those who inhabit Malaya is rice. Therefore, the earth must yield her increase, if all inhabitants of Malaya are to be well fed. But the Peninsula, as sad experience has shown in the past, is far from self-supporting in the matter of its rice supply. *The Malayan Agricultural Journal* for last month shows that only $32\frac{1}{2}\%$ of the rice consumed in Malaya last year was produced in Malaya. Worse than that the local production of rice, which in 1921 was 254,538 tons had decreased to no more than 180,328 tons in 1929. Last year we imported 555,539 tons of rice, a larger quantity than ever before, and paid for it $57,911,429, a sum which might have gone to enrich Malaya itself, had we grown the rice locally. I know that the Malay Rulers have shown the closest personal interest in stimulating their people to grow more rice. Nevertheless the position continues to be unsatisfactory. Greater attention to control of water both in the matter of drainage and of irrigation is necessary. Careful attention must also be paid to manuring the land and to the planting of suitable strains of improved seed. Above all, there

must be unceasing industry on the part of the cultivators, otherwise there can be no real progress. Very great efforts have been, and are being made in this country to promote the cultivation of rubber, coconuts and oil palms; but the time has now come when more attention should be paid to rice cultivation as well as to pastoral industries, in order that the staple food of the people may be made available locally. Large undeveloped areas in this country still lie idle, with abundant water supply, suitable for producing rice crops; and I hope that this century may witness in Malaya both extensive development of the rice industry and effective establishment of pastoral industries. Nothing could do more to provide the actual necessities of life and to settle the population of this country, in the King's phrase, "on a firm foundation of social and political stability."



Governor of the Straits Settlements
and
High Commissioner for the Malay States.

Singapore,
Government House,
8th April, 1930.

EDITORIAL.

With the lapse of time, the interest which centres in the organisation of agricultural research and extension work in the tropics continues steadily to augment.

The Organisation and Work of the Department of Agriculture.

In the Crown Colonies and Protectorates, the impetus given to the question by the report of the Lovatt Committee on the staffing of Colonial Agricultural Departments, the recommendations of the Colonial Conference of 1926, the report on the same question by the Colonial Office Committee in that year and the recommendations of the Imperial Agricultural Research Conference 1927, has caused attention to be focussed on the problems of the organisation of agricultural research in the tropics and the dissemination of information from such research in a manner which has never before occurred.

On parallel, through distinct lines, is the report of the Royal Commission on Agriculture in India, presided over by Lord Linlithgow, which was issued in 1928, while the latest addition to the series of reports and recommendations for the better organisation of tropical agriculture is that of the East African Commission presided over by Sir A. D. Hall which is reviewed elsewhere in the current issue of *The Malayan Agricultural Journal.*

Ideas on the organising of agricultural research and investigation have gained enormously in importance and in precision during the past decade. It may now be safely said as a result of the attention which has been devoted to the subject and the numerous discussions which have taken place concerning its various aspects, that ideas of competent thinkers on the methods which should be employed both in the organisation of research in the tropics and the dissemination of information are becoming very clearly crystallised and standardised throughout. It is now important that the trend of these ideas should also become clearly apprehended both by the various Governments concerned and by the agricultural communities which they are intended to benefit, inasmuch as concentrated study of a problem which affects the welfare of communities can be of little avail if the conclusions arrived at are not fully understood.

It may, perhaps, be pointed out here that it is now generally accepted that quite as much attention is required to the extensional services, i.e. those which are connected with the dissemination of information, as to the conduct of research work itself, and it is essential that definite channels should be established by which the results of the research workers can flow to the different sections of the community. This is accomplished by personal contact, by demonstrations, by cinema films, by exhibits and by the printed word. One

of the most important steps consists in the establishment of local demonstration and test stations where the results obtained by research work can be demonstrated in the field to cultivators.

Moreover, in order to achieve uniformity of aim and complete understanding among workers, frequent contacts between those engaged both in research and extension work in different centres of activity are essential and this is best provided for by the holding of periodic conferences. The importance of such conferences is stressed by all authorities.

Recently, Mr. F. A. Stockdale, Agricultural Adviser to the Colonial Office, paid an official visit to the West African Colonies and in the course of that visit attended the West African Agricultural Conference organised by the various West African Governments and attended by delegates from the Agricultural Departments of each Colony. It would appear from information recently to hand that the conference proved its value in co-ordinating and unifying work and avoiding overlapping.

A proposal for organising similar conferences in the Far East was put forward at the Pacific Science Congress held in Java in May, 1929. It is hoped that the proposal will ultimately be realised, inasmuch as in this extended field of work, gatherings of this description can prove of great value.

Manuring of Rubber.

To this number of the Journal, an important review of the present position in relation to the manuring of rubber is contributed by Dr. W. B. Haines, Head of the Soils Division of the Rubber Research Institute of Malaya.

There is probably no subject in the whole range of tropical and temperate agriculture which has been productive of more diverse results and more acute controversy than the question of manuring rubber. It seems, however, not unlikely that a great deal of the diversity of opinion which has been and is still expressed on this important subject may be due to lack of understanding of the position.

Everybody realises that, in general, it is impossible to continue for an indefinite period, the removal of crops from an area of land without recourse to measures of restoring the elements of fertility which are removed.

It is not, however, so generally realised that the problem in relation to rubber cultivation is a very specialised one and differs in its general and practical aspects from the manuring of crops such as rice, coconuts, tea, coffee, sugar or tapioca, inasmuch as in all these crops the annual toll of plant food removed by the crop itself is considerable and if continued cropping is resorted to without restoration of plant food to compensate for what is removed by the crop, soil exhaustion will normally set in.

With rubber the case is otherwise. The actual amount of plant food removed from the land in the act of taking off a crop of latex is, to all intents, negligible; consequently, the problem of manuring rubber does not comprise the restoration of plant food removed by the crop, but rather the maintenance

of fertility by guarding against losses which may occur by other means and particularly in supplying deficiencies which have arisen, either owing to natural deficiencies, to accidental losses, e.g. by wash, or as the result of the previous cropping of the land which has led to the exhaustion of plant nutrients. Particular interest attaches to Dr. Haines' observations concerning the possibility of finding some stimulant which when applied to the soil may, through some physiological action, increase the flow of latex. It may be said, in fact, that the manuring of rubber in its present aspects opens up a series of questions in relation to crop husbandry which have so far not assumed prominence in connection with other crops.

Cultivation of Pineapples.

In the Editorial of the February issue of this Journal, attention was directed to the position of the Malayan pineapple growing industry.

In the present number, Mr. Grist contributes an article in which methods of cultivating pineapple as practised in Malaya, in Hawaii and in South Africa are contrasted and compared; this comparison should afford food for thought to those who are interested in the industry and may serve to attract the attention of those who at present are not so interested but who may be induced to give the matter their consideration as a planting proposition.

There seems to be little doubt that, on natural grounds, Malaya offers a field for the exploitation of this type of cultivation which is unsurpassed by any other region in the world; consequently it is of importance to ascertain how far Malayan standards of cultivation compare with those practised in other producing centres and to what extent the industry, which is at present entirely carried on as a catch crop, may be capable of being placed on a more permanent footing. In the consideration of these questions, economic factors must of course largely enter.

The Hawaiian pineapple industry enjoys the advantage of a protection in the market of the United States; this security is not at present shared by the Malayan and South African industries in the English market.

A necessary adjunct to improving on the cultivation of pineapples as a major crop is information concerning the manurial requirements of the plant and the toll which the cultivation may be expected to take from the soil, and it is of interest here to record that the Department of Agriculture is at present considering the establishment of an experiment station for the investigation of problems connected with the cultivation and manuring of the pineapple crop in the Island of Singapore.

In a subsequent article, Mr. Grist will review and compare manufacturing methods as they exist in the three countries under consideration and will summarise the world production of canned pineapples. With the publication of this information, growers in Malaya will be placed in a position of being able to see clearly for themselves how the local industry compares with practice obtaining in other countries.

THE ECONOMICS OF THE RICE SITUATION.*

BY

H. A. TEMPANY,

Director of Agriculture, S.S. & F.M.S.

The rice situation is of great importance to Malaya, and, on account of the fact that the country is largely dependent on imports of this commodity, close and constant watch should be kept to guard against any possible shortage of supplies. Malacca has for some time past taken a keen interest in rice production for which reason it is considered to be a suitable centre for an exposition of some of the economic factors affecting the production of rice.

There are two schools of thought on the subject of rice production in Malaya. One holds that rice production should be encouraged by all possible means so as to reduce dependence on outside sources of supply. The other maintains that agricultural prosperity has been built on a foundation of exports of other staples and that while rice cultivation should be maintained at its existing level and encouraged by all reasonable means, large scale expenditure and effort with a view to encouraging greatly increased production are to be deprecated inasmuch as they may lead to a nett loss of prosperity. No doubt the latter view seems at first sight to have been justified by results in the past. Malaya has risen to an extraordinary height of prosperity apparently as a result of it, but the matter is due for re-consideration as it is by no means certain that the conditions of the past will be continued in the future. In fact, the question of future policy in this respect will depend on the future of rubber and of other products of Malaya and the manner in which their economic position reacts on the purchasing power of the Asiatics. Malaya is essentially a rice consuming country and it may surprise some to know that the *per capita* rice consumption is higher in this country than in any other in the world.

In view of the fact that the purchasing power of this country for rice depends upon the production of other commodities, we may forget for a minute that money is the medium of exchange and take as a basis the purchasing power of one staple in terms of another. In the accompanying graph is shown therefore the purchasing power of 1 lb. of rubber in terms of lbs. of rice. This throws some valuable sidelights on the situation, e.g., it transpires that the economic situation at present is practically the same as it was in 1920 or 1921; in 1920, a high price of rubber was balanced by a high price for rice; in 1921, both prices dropped, leaving the relative economic position unaltered.

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* The following is an abstract of the main points in a lecture on the above subject delivered by the Director of Agriculture before the Malacca Planters' Association on 9th March, 1930.

The present average yield of rubber for the Malay Peninsula is approximately 400 lbs. per acre, while the average yield of cleaned rice is 600 lbs. per acre, so that even at present prices, rubber is probably rather more profitable to produce than is rice.

But in reality, the position is not as stable as one might believe from the above-mentioned facts. The factors which may affect the future relative position of these two crops are as follows:—the price of rice may rise; small-holders' rubber yields may drop; rice producing conditions in Malaya may improve; rubber prices may still further decline. Malaya has not yet experienced the conditions which will result when a high price for rice coincides with a low price for rubber.

With reference to the possibility of improvement in the rice producing conditions it may be mentioned that such improvement is very possible by improved irrigation facilities, by better cultivation and manuring and by the use of improved strains of seed. With a higher yield of rice the economic position would materially change.

A further examination of the rice situation reveals the following facts—local production is steady, imports and consumption are steadily increasing and there is no tendency to substitute other grains for rice as is the case in the Philippine Islands, Java and Japan.

No marked increase in area under rice in Malaya can be expected under present circumstances; unless better facilities for cultivating the crop are provided. The work of the Department of Agriculture, which has already shewn favourable results, has been mainly directed to seed selection. Improvement of crops through better irrigation has been effected in a few districts on a small scale. The question of manuring awaits solution, but there is little doubt that some such system is necessary and its application would tend still further to improve the lot of the rice cultivator.

A comparison of the rice position in Malaya and that obtaining in other neighbouring countries is instructive. There are two very definite divisions, viz., rice importing countries and rice exporting countries. In the former division there are two groups—the first British i.e., Malaya and Ceylon which rely for the majority of their rice supply on imports balanced by an export trade in other commodities;—the second, American, Dutch and Japanese which rely on developing domestic production.

The three large exporting countries are British India (which supplies about 50% of the exports), Siam and Indo-China. The exporting countries have a nett available surplus for export of about 4,350,000 tons. The present tendency is for exports to remain steady and for imports to increase. It is probable, therefore, that unless efforts are made to relieve the present growing demand by increasing the area under cultivation or the crop per acre, or both, or by encouraging the use of other foodstuffs to replace a part of the rice demand, the price of rice will show a continued upward tendency which will not be balanced by prosperity in other agricultural industries.

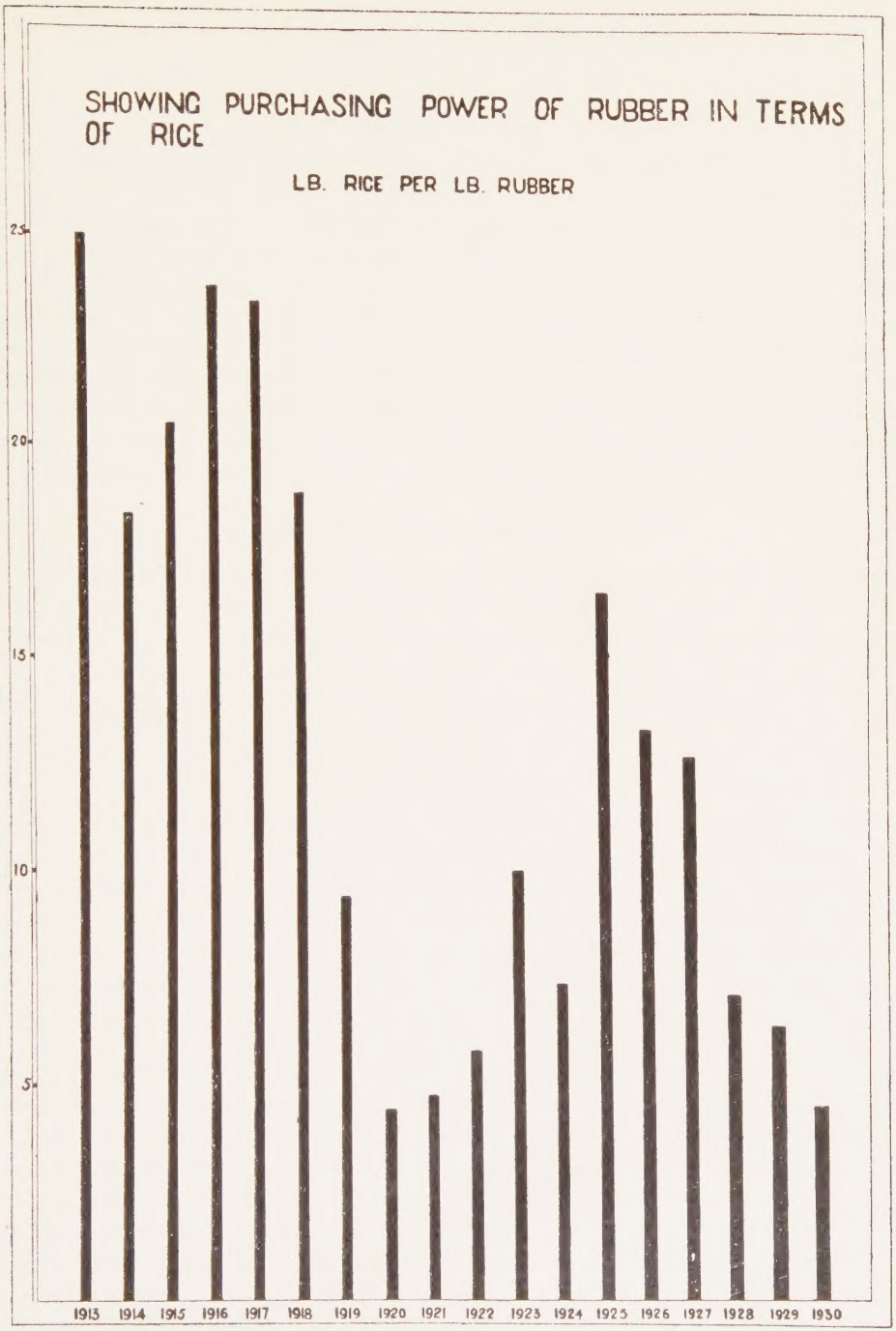
In passing it may be pointed out that the influence of China on the rice situation is unique. When prices are high, China's imports of rice are low, the quantity imported increasing with a decline in prices.

Regarding rice yields per acre, Japan has the highest of Eastern nations having risen perceptibly during the past 15 years; the Philippine Islands also shew a considerable rise; while Malaya, Ceylon and India remain stationary.

In the foregoing paragraphs, an attempt has been made to provide a succinct review of the rice situation so as to enable those interested to appreciate the main factors operating in a complex situation which profoundly affects the well-being of Malaya.

Taken in conjunction with the review of the rice situation in Malaya which appeared in the March issue of this Journal, it enables a fair estimate of the situation to be made and allows the probable course of future events to be envisaged.

It seems unlikely that Malaya can become entirely self-supporting in the matter of rice production at least for many years to come, but on the other hand, the existing situation whereby a rapidly increasing population remains unbalanced by any corresponding increase in the domestic food production, coupled with the facts that no marked increase in the world's available export excedent of rice can be expected; while the ever-present danger of temporary shortage owing to reduced crops in India appears to point conclusively to the need for the most careful consideration of measures calculated to increase the present domestic production of rice and other foodstuffs in Malaya beyond the dangerously low level which at present obtains.



The horizontal lines indicate the number of lbs. of rice which could be purchased for one lb. of rubber.

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MANURING OF RUBBER.

BY

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The last few years have seen a rapidly growing interest in Malaya in the use of artificial manures on rubber estates. This interest has arisen from two main sources: first, the very excellent results which have been reported from certain experiments in Sumatra, and secondly, from the growing realisation that large areas of rubber have passed their maximum yield and require measures to arrest deterioration. Since tapping has for many years now been conducted on a proper conservative basis, this deterioration can be attributed mainly to soil changes, and it is natural to turn to methods involving the use of chemical plant foods as stimulants.

Special Features for Rubber.

In approaching the subject for a general discussion it is first of all necessary to realise the very sharp contrast between the conditions of rubber cultivation and those of temperate zone farming. Our knowledge of the effects of fertilisers has been mainly built up from experience with seasonal crops. These are grown under the best and most intensive conditions that soil cultivation will allow, and usually end in the removal of a large amount of plant food from the soil in the harvested crop. Manuring therefore aims at replacing these plant foods in such a way as to produce the maximum results on the crop during the ensuing season. Certain residues may be left after harvest, but the main return is always seen within the year. The case of a rubber plantation offers a very striking contrast to these conditions. The crop is not seasonal nor does it remove permanently any very appreciable quantities of plant foods. The natural cycle of changes are those of a forest in which a considerable proportion of the available food passes round a continuous cycle, from the soil to the tree, and from the tree back to the soil again in the form of leaf fall. The necessity for manuring arises, therefore, not so much from the necessity to renew losses taken away by the crop, as from needs caused by a break in the natural forest cycle. The open conditions fail to conserve the leaf fall and general humus reserve unless special measures are taken. The resulting effects are relatively slow and in consequence also the benefits from manuring are also likely to be slow. One cannot look forward to a full return within a year as the farmer does, but must await rather the restoration of a normal balance attained through several cycles of leaf development and leaf fall. The important assistance rendered by modern methods of soil conservation will be obvious, in that the cessation of surface wash and movement helps to retain the fallen leaves.

Another factor making for slow returns from manuring is that latex yield depends primarily on the bark condition of a tree, and this changes much more

slowly than the leaf canopy in response to the improvement in the conditions of nutrition. This brings into prominence another contrasting feature, namely, that the age and previous history of the crop are important factors to be considered, whereas the farmer may start anew each season with fresh seed. The rubber planter must consider deterioration of both his soil and his crop, while the farmer considers his soil only. This makes two distinct stages in recovery instead of one, and each stage conditioned by a very different set of factors.

As far as our present knowledge goes, the aim of manuring can only be the maintenance of a normal yield. So far there is no suggestion of specific manuring in the sense of stimulating latex secretion beyond the normal. Each tree must be regarded as having a normal potential yield, and, although this varies greatly from tree to tree, we do not yet expect to turn a natural bad yielder into a good yieldder by manuring. Growth under good conditions will give the normal yield, and if these conditions deteriorate it is possible to restore them and maintain yields by providing the necessary plant nutrients. A specific treatment which would greatly increase latex secretion may possibly be developed in the future through some discovery regarding the plant's physiology—at any rate, our knowledge is not extensive enough to rule out the possibility. But, such a discovery might be regarded as a doubtful gift for the scientist to make to an industry which has not yet solved its problem of over-production. At present, the question of increasing the *potential* yield of rubber per acre lies in the direction of perpetuating strains with an inherently high yield by methods of budding or breeding.

Green Manuring and Cultivation.

The term "manuring" generally refers to the use of chemical fertilisers, but space must be devoted also to the mention of the value of green manuring for rubber estates. Green manuring has as its main object the provision of supplies of organic matter to the soil. It is possible that mineral plant foods may be rendered more available, since a coarse feeding cover might extract from the soil more food than the main crop could do, and this food is passed back in an available form when the cover dies or is turned into the soil. But the main function of the plant residues is to support the bacterial life of the soil, without which nitrogen fixation cannot go on. Another service that covers have performed in rubber is to break up the soil. The question of doing this by mechanical means is one that has naturally been viewed very conservatively by rubber planters. Under rubber cultivation there can be no doubt that some soil types tend to become consolidated in a way quite foreign to a forest soil, but the correction of this by mechanical means has serious objections on the grounds of root disturbance as well as expense. In such circumstances, a cover such as Mimosa has been known, by the vigorous penetration of its roots, to produce vastly improved conditions. The restoration of air and water movement to layers previously consolidated opens up fresh areas and supplies of plant food. But it must be remarked that in general, in Malaya, green manuring in old rubber has not promised much success. The part it may play in conjunction with

chemical fertilisers may be large, but that still remains to be worked out in detail. Green manuring will undoubtedly play a leading part in the work of reconditioning the soil in such areas as are marked down for re-planting, since the objections to mechanical soil disturbance are then quite removed, and conditions for growth of cover are vastly improved.

The use of organic fertilisers which add to the humus supply, such as cow dung or the artificial "Adco" product, is not here specially referred to. While their merits can scarcely be in question, they are nevertheless eclipsed by the chemical fertilisers on the question of adequate supplies for the large areas which are concerned.

Mature Rubber.

Turning now to the special needs of mature rubber we find that areas requiring the help of fertilisers fall into two distinct classes. On the one hand we have rubber which was originally planted under favourable conditions and has given good results in the past, but which has begun to show signs of falling off. As we have seen, the reason for this deterioration lies mainly in the loss of humus and the cessation of nitrogen-fixing activities in the soil. The usual need in such cases is nitrogen. Fertilisers supplying this element are urea, sulphate of ammonia, sodium nitrate and calcium cyanamide. Of these, ammonium sulphate has proved the most popular, although cyanamide has also proved effective and may be of added service by supplying another important plant food, namely calcium. The signs of nitrogen starvation may be seen in the leaves. These are sparse, of small size and of an unnaturally light yellow-green colour. Manuring with nitrogen immediately produces an increase in foliage and a darkening in tint. The darker tint will often be observed in the location of dwellings where the trees receive extra nitrogen in the form of urea from human excreta. The improvement in foliage is not usually accompanied immediately by increase in latex yield.

The other distinct type of case is given when the soil has been exhausted by the cultivation of other crops previous to the planting of rubber. In such cases, in addition to the poverty of leaf, the growth is usually stunted and the bark conditions are extremely poor. The trees never reach a normal yield. Since all the plant foods have been exhausted in their available form, a complete fertiliser may be preferable to nitrogen alone. It may be remarked that when the bad conditions have gone on for a very long time, the prospects of producing remunerative results become very remote. In such cases, with the modern prospect of high-yielding budded rubber, it may often be better to consider replanting at once, rather than devote time and money to a treatment of uncertain promise. A replanting scheme may not be so very much more expensive, either of time or money, than manuring, to bring the area into normal bearing, since the essential feature in both cases is the growth of completely new tappable bark. At the conclusion, the replanting will provide a much higher *potential* (inherent) yield than the old planting ever had, and one result of this is that any future expenditure on manuring or other improvements is more feasible,

since the cost is still the same reckoned per acre of soil but less when reckoned per lb. of rubber produced.

The plantings which result from reclaimed 'lallang' grass land may be regarded as intermediate between the two cases considered above. Although the plant nutrients are usually exhausted by the previous crops, a certain recovery takes place during the years of abandonment. The rubber will require earlier manuring than in the case of virgin soil, but it makes sufficiently good growth to promise adequate response to such attention.

A second type of food deficiency which may be recognised by the appearance of the trees is that of potash. A large proportion of Malayan soils show a very small supply of potash. The type in which the deficiency is most marked is sandy, and is often rich and dark in appearance from the amount of humus which it contains. This is a very unusual feature for a sandy, well-aerated soil. It would seem in this case that the organisms responsible for the decomposition of the humus are themselves in a similar position to the trees and unable to find sufficient mineral food. The symptoms of potash starvation produced in the tree are stunted growth, and leaves which are crinkled and often unnaturally dark green in colour. These tend, however, to turn completely yellow quite prematurely, the discolouration beginning at the edges. The symptoms indicate that the ratio of nitrogen to potash is too high and the addition of sulphate of potash is sufficient to restore normal growth and healthy conditions. By stimulating bacterial activity it accelerates the setting free of the locked up nitrogen in the organic matter.

In regard to phosphate, Malayan soils usually contain good reserves, so that mature stands of rubber usually do not require this element. Indeed, some experiments using phosphate alone have had the effect of depressing latex yield and this has led to the recommendation that the use of phosphate on mature rubber should be approached with caution. On the other hand, the available phosphate appears to be badly exhausted by the crops which have preceded the rubber, for which reason phosphates often produce great stimulation of growth in young rubber which has been planted on such sites. There is also some reason to think that the young tree may have a greater need of phosphate than the mature tree. Reports from Sumatra indicate that good results have followed the use of phosphates even in old rubber and that basic slag and rock phosphates have proved more reliable than superphosphate.

On hilly situations the case sometimes arises that the soil, though containing an adequate proportion of plant foods, exists as such a thin layer over gravel or rock as to be insufficient to support normal growth. In such cases a complete fertiliser is the logical requirement.

Immature Rubber.

In addition to the maintenance of yields, manuring may also be applied to produce earlier maturity of young rubber. It is well known that clean weeding, by stimulating humus decomposition, causes a more rapid growth in young

rubber than is observed when covers are allowed to grow. It may be suggested that in some cases this is an extravagant policy with bad after-effects, and it might be better to pursue the more economical policy of establishing a cover to reduce humus losses, while making up for the retardation in growth by the use of artificial fertilisers. One caution is necessary in manuring young rubber, namely, that if nitrogen is given in too heavy a dose the growth of the leaf canopy may outstrip the strength of the young stem and cause the trees to bend over and break. It may be said that on areas which have been reclaimed from swampy conditions nitrogen is not required, at least for many years. Sufficient stores are locked up in the accumulated vegetable debris and may be set free by the judicious use of mineral fertilisers such as kainit (a potash fertiliser) and basic slag (phosphate).

Resume of Results to Date.

The best known and most convincing results from the manuring of rubber are those obtained by the Holland American Plantations in Sumatra. Details have been published by J. Grantham in "Archief voor de Rubbercultuur" (August 1924 and October 1927). The figures have since been repeatedly reproduced and it will here suffice to recall the main features. Rubber of about 8 years old growing on a white sandy-clay soil and suffering from die-back with symptoms of nitrogen starvation, was manured with nitrogen fertilisers. The yield in 1919 at the beginning of the test was rather under 300 lbs. per acre and has remained fluctuating round such figures on the control plots ever since. The manured plots began to improve at once and the yield on them has gone steadily forward during ten years or more and has now reached the normal value of good rubber round about 700 lbs. per acre. The benefit does not yet appear to have reached its maximum, according to latest reports. The greatest benefit was from nitrate of soda applied at the rate of 5 lbs. per tree every year, but the plots receiving an equivalent amount of ammonium sulphate in alternate years are not far behind. Such a return is in the highest degree economic, but it has only been found so far on the particular type of white soil. In other cases and with other soils results have usually not been so striking.

Schmöle reported results from a number of experiments in other parts of Sumatra ("Archief voor de Rubbercultuur," June 1926) which in the main did not give such conclusive results. It appeared that all tests on the typical white sandy-clay soil similar to that on which the H.A.P.M. had got such success showed a response to nitrogen. Other soils often showed a small response to nitrogen, but rather doubtful results with other constituents. The results from Java summarised by De Vries showed for the early years that only about one quarter of the experiments gave satisfactory increases, while the remaining three quarters were still dubious as to conclusions. Similarly in Malaya, results have been on the whole inconclusive during the 2 or 3 years that experiments have been running, but there have been enough positive results to indicate great possibilities. It remains to define clearly the conditions which decide success or failure. The general inference which it is possible to make at this stage is

that all cases of a quick economic return have been from rubber of a young age class (up to 12 years or so). All that can be said with regard to the majority of experiments on older rubber is that improvements in appearance can usually be effected quickly, but the response as regards yield is delayed beyond the 2 or 3 years of which we have so far any record.

Conclusion.

From the foregoing remarks it will be clear that manuring of rubber must be regarded as still in the experimental stage. Estates should be encouraged to make the small expenditure necessary to provide for their own experiments. Such experiments, being conducted under their own local conditions, will give results that may safely be relied upon for guidance as to further expenditure. In regard to such experimentation they would do well to invite the help of their Research Institutes in laying down the plans, since the value of an experiment depends very much upon correct design at the start. The one fact that must not be lost sight of is that no inference as to the results can be exact unless control areas are left as a basis of comparison. It is also well to have expert advice as to the type of fertiliser most likely to give results under the special conditions. Although nitrogen is by far the most general need, there are cases where it would be waste of money to apply it alone. Peaty conditions usually maintain nitrogen reserves for very many years, while in other cases the addition of nitrogen can only be effective if balanced by other constituents. In passing, it might be pointed out that experiments which fail should be put on proper record as well as those which succeed. It is only in an economic sense that failure means rejection; in a scientific sense a failure may give new information as valuable as a success.

The future of manuring in rubber would seem to show good prospects. In a number of cases the results already show a good return, and it cannot be doubted that as the length of time and the number of experiments increase, a larger proportion of them will show good results. Another factor for the future which must be reckoned with is the very much higher production per acre which may be expected from buddings now being planted. In such a case, the cost of manuring per pound of rubber produced will be correspondingly reduced. A high yielding tree requires no more food for health than a poor yielder. Thus, areas which will later be coming into tapping may repay more handsomely the cost of using fertilisers to keep them up to their full yielding capacity. At the present time the most important point to be realised is, in the writer's opinion, that manuring of mature rubber should be begun in time. If deterioration sets in, and is allowed to run unchecked for a number of years, much time and money must be spent to make up for the leeway lost. The value of manuring must be considered not simply in terms of the increased yield from an area, but in terms which allow for the amount of deterioration which would have been inevitable without such treatment. The profit and loss account of such treatments must also be carried over a number of years for fair conclusions, since the processes are slow by which the trees appreciate or depreciate in their health and yielding-vigor.

PRELIMINARY OBSERVATIONS ON *SOGATA* SPP. PESTS OF PADI.

BY

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Assistant Entomologists.

An outbreak of *Sogata* sp. probably *pallescens* occurred in Province Wellesley and in the Krian District in the latter part of 1929, and was reported to the Entomological Division in December. Visits were paid to both Districts, but it was impossible to carry out extensive field observation owing to the sudden disappearance of the insects.

The first occasion on which species of *Sogata* was recorded as damaging padi, was in 1925, (1) when an outbreak occurred in the Krian District at the latter end of that year. Padi plants at that time were stated to appear decidedly unhealthy, and the opinion was expressed that their state was probably primarily due to delayed planting followed by excessive rains.

A further opinion was put forward (2) that "latest planted padi and padi subjected to flooding or deep water appeared to be the most susceptible to attack. Control measures were tried, but before they could be put into operation extensively, the insects began to disappear as quickly as they had at first appeared. At the close of the year, after two weeks of dry weather they had practically disappeared. It is certain that much of the padi on which the insects appeared will give little if any crop, but it is at present difficult to decide if most of the damage was really due to the insects or to adverse climatic conditions under which the plants were growing."

Little is known regarding this sudden disappearance of the pest. A theory has also been advanced that a variation in the acidity or alkalinity of the water may be responsible. It is, however, unlikely that any variation which does occur has any effect on the chemical composition of the cell sap.

This theory originated through the discovery that if water is run off and replaced by fresh water, the insects disappear after two or three days.

It has been noticed in India that continuous rains are favourable to the development of *Sogata*, (3) but in Krian district, at least, the contrary has been observed, a heavy rain during an outbreak causing the disappearance of the pest. In the writers' opinion degree of humidity would seem to be the determining factor of the duration of an outbreak. As far as it is possible to ascertain, *Sogata* has never been observed in any numbers in dry areas.

In India, a *Dryinid* has been recorded (3a), as a parasite on the nymph, but in Malaya, no parasites or predators have so far been recorded. It was found, however, that portions of padi leaves containing egg masses brought in from the field and examined in the laboratory, were infested by mites which may

be responsible for the destruction of eggs, though this has not yet been demonstrated.

Sogata spp.

Infected plants were forwarded to the Entomological laboratory from Parit Buntar and Province Wellesley and the nymphs which emerged were kept on padi plants grown in water under bell jars. Eggs were obtained on the 8th January, 1930, and the nymphs emerged on the 13th. They became adult on the 27th January.

A critical examination of the material and comparison with identified material from the Entomological collection shewed that apparently two species of *Sogata* were present—*Sogata pallescens* Dist., and *Sogata distincta*, Dist. The collection has one other species of *Sogata* represented, namely *S. furcifera*, Horv., but at present it has not been possible to find any characters which distinguish *S. distincta* from *S. furcifera*.

Both the latter insects are readily separable from the specimens of *S. pallescens* in the collection, but it is a noteworthy fact that all the specimens bearing a name label *pallescens* are females, while all those with name labels *furcifera* and *distincta* are males. It would seem that the three species are either synonymous or the specimens have been wrongly identified.

Notes on Life History.

When about to lay her eggs, the female extends her ovipositor, or egg laying organ, from its position of repose, which is in close contact with the abdomen, until it is at right angles to the body.

Then, with an up and down movement, makes a slit of variable length in the midrib on the lower side of the leaf blade for the reception of the eggs.

On completion of the slit, she walks forwards and deposits her eggs.

The ovipositor is composed of six grooved portions, and during the process of egg laying, their movement is irregular, the lower portions remaining more or less stationary, while the upper portions execute a rotatory motion.

The site of oviposition turns brown afterwards and about three days after this the nymphs emerge.

The overall size of the egg is about 1 mm. to 1.2 mm. long and about 0.2 mm. wide behind the head of the embryo.

Some time before the nymph emerges the embryo becomes active inside the egg and starts to bend backwards and forwards, by which means it gradually works the egg up to the surface of the leaf. Very little lateral motion has been observed during this process which was watched in the case of two eggs which were exposed laterally by cutting away the leaf to one side of them, i.e. the surface of the midrib. The embryo is assisted in this operation by a stout conical cap situated at the anterior extremity of the egg. This cap is entirely

transparent and readily distinguishable from the body of the egg which is opaque white, the eyes alone being pigmented at this time, but a few minutes after the egg has reached the light, scattered pigment is apparent on the anterior region of the head of the enclosed nymph. There is a distinct line of dehiscence at the base of the cap which breaks off after it has penetrated the cuticle of the leaf or during the process of penetration, in which case it remains behind in the cavity made by the ovipositor of the female. It may however remain adhering to the ventral surface of the egg. When the egg is protruding from the leaf for about 2/3 of its length the embryo ceases its movements and a considerable amount of gas becomes apparent in the form of a chain of bubbles dorsally. The abdomen expands and contracts and forces the gas into the thoracic region. After about a quarter of an hour the egg splits dorsally in the region of the thorax, the split extending in both directions and the nymph emerges much in the same way as in an ordinary ecdysis.

It is the writers' opinion that the pressure of the gas is instrumental in causing the initial slit.

The nymph on hatching is whitish, sometimes greyish, and after a short period of rest begins to feed, usually on the leaf lamina. Nymphs of later stages frequently feed lower down on the plants, attacking the leaf sheath.

There is an appreciable difference in the colouration of the third stage nymph from that of the nymphs of the preceding stages, and in the following stages pigmentation is more marked, particularly dorsally.

The shortest recorded period between the two skin changes is fourteen days, but it may be as long as three weeks, and the duration of the egg stage is five days.

Notes on the feeding of *Sogata*.

In a report from Mr. Mason, Field Officer, Penang and Province Wellesley, it was pointed out that the insect feeds rather higher up the plant in the early morning, but descends later when the sun becomes more powerful. This change of position is less marked in the laboratory where the light is diffused but it has been possible to trace a distinct tendency to descend the plants even under these conditions. But for Mr. Mason's observation it is possible that this habit would not have been noticed.

The insect is a very restless feeder and it runs round the leaf on the slightest provocation. It is therefore exceedingly difficult to observe the insect with a lens for the approach of one's fingers or a lens causes it to hide behind the leaf immediately.

While feeding, the stylets are inserted into the leaf at an angle to the leaf surface slightly inclined backwards. Usually two or three trials are made before the insect finally settles down to feed but after a short period of feeding it may withdraw its stylets and start sucking in another place, usually only a millimetre or so away from the previous puncture. A single individual may make a considerable number of punctures in a small area, but in spite of this, it has not been

possible to detect any outward sign of injury after the insect has proceeded to another spot. While feeding, the insect not infrequently runs a step or two to one side, the legs on the opposite side retaining their hold. The operation may be repeated on the other side.

The movements of *Sogata* are peculiar, the insects running forwards, sideways or backwards with equal facility. Movement from one spot to another appears to consist in a number of short and erratic excursions, the insect sometimes finishing quite near the spot from which it started though it may have travelled a considerable distance.

During the operation of feeding, the insect exudes small drops of clear fluid, which is said to provide a suitable medium for the development of fungus.

Nature of Injury.

Padi attacked by *Sogata* spp. is readily detected in the field, the areas being distinctly yellowish and well defined. Closer examination will reveal the presence of narrow reddish brown patches on the leaves—usually the convex surface—indicating the site of oviposition.

Control.

It has been satisfactorily demonstrated, as mentioned previously, that running off the water from attacked areas is an efficient control method, where this practice is possible.

In areas where there is no regular irrigation system, no satisfactory control measure has been discovered. The use of large drag nets, similar to those employed in the control of swarming grasshoppers has been suggested, but, as *Sogata* spp. jump downwards when the plants on which they are sitting, are disturbed, this is hardly likely to be effective. Furthermore, it is admitted that if this operation is carried out on a calm day, the cloth sags and breaks the padi plants.

References.

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2. Annual Report, Chief Field Officer, Department of Agriculture, S.S. and F.M.S., 1925.
3. The Rice Leaf-Hoppers (*Nephotettix bipunctatus* Fabr. and *Nephotettix apicalis* Motsch) C. S. Misra. Mem. Dep. Agric. India Ento. Ser. Vol. V, 1917—20, p. 210.

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CULTIVATION OF PINEAPPLES.*

BY

D. H. Grist,
Agricultural Economist.

Hawaii and Malaya are the world's main centres for the production and canning of pineapples. The estimated area in bearing in Hawaii is 50,000 acres; while Malaya has a total of about 50,000 acres, 42,000 acres of which are situated in the State of Johore, and 8,000 acres on Singapore Island. Pineapple canning is also carried on to a lesser extent in South Africa (centred at Port Elizabeth), in Formosa and in parts of Australia.

The following account is a comparison of the systems of cultivation and the conditions obtaining in Malaya, Hawaii and South Africa.

Climate.

The climatic conditions in these three countries of production vary considerably. The following table shows the average rainfall and temperature.

Country.	Average Rainfall inches.	Average mean shade temperature.
Malaya (Johore) ...	89.09	80.0 F.
Hawaii (Honolulu) ...	31.60	74.6
South Africa (Port Elizabeth) ...	22.51	63.6

In Hawaii, the precipitation is heavier from November to March inclusive, but in South Africa the rainfall is fairly evenly distributed throughout the year. The rainfall in Johore is somewhat erratic; the rainy months are generally December to March, but there is usually an ample rainfall each month.

The above figures demonstrate that pineapples will flourish within wide ranges of climate in the tropics or sub-tropics, but the system of cultivation must vary between these countries to adapt the crop to local climatic conditions.

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* The following account is compiled from information obtained over a number of years by Officers of the Department of Agriculture S.S. & F.M.S, regarding Malayan Pineapple cultivation; "Notes on the Pineapple Industry in Hawaii" supplied to the Director of Agriculture from a private source; and "The Pineapple Industry in South Africa" from a report by Mr. C. A. O'Conner of the Mauritius Department of Agriculture. Reference has been made to "Notes in Pineapple Cultivation" appearing in "*The Tropical Agriculturist*" Vol. LXX, No. 1. January 1928, and to "Growing and Canning Pineapple in the Hawaiian Islands," in *Dun's International Review*, April 1928.

Soils.

Pineapples will grow on a wide range of soils, but favour the heavier types of soil with good soil aeration and drainage. The soils of Hawaii are of volcanic origin and rich in mineral plant foods. In Malaya, the crop thrives best on the stiff clay types of soil. A rich soil is held to be unsuitable as it tends to develop the size of fruit at the expense of flavour. It is for this reason that the fruit produced on the poorest of the Singapore lands have the best flavour when canned. It is probable that with a rich soil, growth is more rapid in Malaya than in either Hawaii or South Africa with their lower rainfall and temperature.

Varieties.

The two main varieties used in canning are the "Smooth Cayenne", a large pineapple with small "eyes", weighing about 5 to 6 lbs. and the "Queen" type, a smaller pineapple, with deeper and rather irregular eyes weighing about 3 to 5 lbs. Opinions differ regarding the relative merits of these two varieties for canning purposes. It is held in Hawaii and South Africa—which have adopted the "Smooth Cayenne"—that the flavour of that variety is superior to that of the "Queen" types. In Malaya, the latter variety is used exclusively for canning as it is held to have a better flavour and to be more suitable for canning. Here again, it is possible that climatic and soil condition may be responsible for these differences of opinion, which, of course, are based on the experiences of the canners. The "Queen" type has two advantages of some importance—it is hardier, and it produces a greater number of "suckers" than does the "Smooth Cayenne", a matter of some importance in replanting or extending areas under the crop.

Preliminary Cultivation.

The fundamental differences in system of cultivation between these three countries is that whereas in Hawaii and South Africa, pineapples are treated as a sole crop, in Malaya they are almost invariably planted as a catch crop; generally in conjunction with Para rubber as the permanent crop.

In each case, it is realised that pineapples cannot be grown indefinitely on the same land: the land must either be rested after a number of years or it must be utilised for alternative crops after carrying pineapples for some years. The Hawaiian rich soils vary considerably; in some cases they produce fruit for three or four years, after which resting for one or more years is necessary; in other instances they are still bearing well after fifteen years. It is reported that many of the soils, however, are finished for pines after eight years. In Malaya, virgin soil is generally used for pineapple cultivation. The pineapples are planted directly the heavy jungle is felled, burnt and cleared. The plants commence to fruit in from 12 to 18 months, and will continue to fruit until the

fifth to sixth year, by which time the fruits produced are small. The rubber which forms the main crop has also become a tree of considerable size, so that further cultivation of pineapples is out of the question.

Much of the Hawaiian pineapple land was formerly pasture land, but newer areas, in many cases, had to be cleared of cactus and rocks. It was never jungle and the islands are not thickly wooded. Abandoned land reverts to pasturage.

The South Africa pineapple land has to be cleaned of bushes and grass.

Both in South Africa and Hawaii, the preliminary cleaning of the land is followed by a thorough cultivation of the soil. In the latter country, 95% of the land is cultivated with caterpiller tractors, steam ploughing equipment never being employed. As mentioned previously, in Malaya the land receives no cultivation before planting the pineapple plants.

Planting.

Pineapple planting material is of four descriptions: viz., ratoons, which are formed from buds on the stem among the roots; "suckers", formed in the leaf axils; slips, formed from buds appearing immediately below the fruit; and crown slips and crowns, formed from buds beneath and around the crown of the fruit. Ratoons and suckers are the most suitable for planting purposes, as they produce fruit earlier than do the less strongly developed slips, which are very small and should first be planted in a nursery to develop a strong root system. The effect of planting material and climate may be seen from the following comparison of the length of time taken for the plants to reach the bearing stage.

Country.	Crowns.	Suckers.
Malaya	18 months	12 months
Hawaii	20 months	14—16 months
South Africa	2 to 2½ years.	

Considerable variation exists with planting distances employed in different countries. The usual Malayan system is to space the plants $5' \times 2\frac{1}{2}'$, with a six foot path at every 100 feet. This spacing gives from 3,000 to 3,400 plants per acre. In Hawaii, it is customary to plant very close, 9,000 to 12,000 plants per acre, with a tendency towards an even denser population of plants. Slips or suckers are usually planted in double rows, 12 to 18 inches between plants in the row, 16 to 24 inches between rows. The distance between the centre of this double row and the centre of the next double row is about 6½ feet.

The South African practice is to plant in double rows, the plants being two feet in the row and two feet apart between rows: a space of five feet is left between the double rows. In this system there result about 6,300 plants per acre.

Suckers and ratoons for planting are cut square at the base, the lower leaves removed and frequently dried in the sun for a while before being planted,

In some quarters it is held that there is no advantage in the preliminary drying, but it appears to be the usual practice both in Malaya and Hawaii.

The plants should be placed from three to four inches deep in the ground—the actual depth depending upon the size of the plant. Care must be taken that no soil or sand enters the bud as it will kill the plant, or at least retard its development.

Cultivation.

After planting, the fields require weeding, but apart from such attention no further cultivation is given in Malaya. In the other countries of production, however, the low rainfall renders it necessary to do everything possible to conserve the moisture in the soil. The usual method of frequent surface cultivation achieves this object, but in Hawaii, exceptional measures are taken, partly at least towards this end. The fields are mulched, with an asphalt-treated paper so spread as to provide spaces necessary for cultivation and harvesting. It is claimed that this mulch (under the commercial name of "Pabco") reduces weeding costs, conserves heat and moisture; and so increases yields as to render it a financial success. The "Pabco" is first spread—sometimes by a machine which lays it flat, turns down the edges and kicks up earth to keep it down— and the plants placed in holes made in it with a trowel. The disadvantage mentioned against the "Pabco" mulch is that it forms a breeding ground for pests. This mulch is widely used in Hawaii. Owing to the heavy rainfall, it would not have the same advantages in Malaya. Pineapple land is ploughed four or five times a year on African plantations, the ploughing being done with oxen.

Mention must here be made of a peculiar feature in pineapple planting in Malaya. The great majority of the areas under this crop are owned by Chinese, who, in many cases, are the owners of the factories. The Chinese owner of land which he wishes developed with pineapples and rubber makes an arrangement with a number of Chinese squatters to plant up his land with pineapples and to keep it clean for an agreed charge per month per acre. Each squatter is thus definitely and absolutely responsible for a portion of the estate, and generally erects his own temporary abode thereon. The agreement provides that a squatter shall get 50% of the value of the pineapples as a bonus, after cartage costs have been deducted and the agreement usually contains a clause which provides for the payment to the squatter of a certain sum per acre for cleaning the pines off the land after five years. In one typical instance, the agreement provided for the payment to the squatter of $1/- an acre a month to cover the full cost of planting and weeding, a bonus of 50% of the value of pineapples after deduction of cartage costs, and the payment by the owner of $8/- per acre for cleaning off land and burning the pineapple plants at the completion of the agreement.

Such complicated methods of management are possible between Chinese and Chinese, but are impossible between European and Chinese.

The usual Malayan contract rates are around $7/- per acre for planting; and for weeding and earthing up plants, $2.50 per acre per mensem.

In Hawaii, the land is manured just before planting, and a further application is sometimes given before the plants commence to bear fruit.

It is difficult to obtain data of the labour requirements for cultivation, but some idea of the probable cost can be obtained from the requirements of an Hawaiian plantation. An estate of three or four thousand acres is run by one man. Under him are Japanese conductors, one for every 1,000 acres. They will have under them ten heads of coolie gangs, each of which would be in charge of about ten coolies at the height of the season. Salaries: Manager about $1,000 per month; Divisional Manager $550; Conductor $90, all sharing in profits.

The permanent labour force is about 60 men per 1,000 acres, a number which is in excess of requirements in the slack season. This number may be increased to over 100 men per 1,000 acres during the busy season. Formerly, the labour force was mainly Japanese, but owing to restriction on Japanese immigration, they have now been largely replaced by Philippinos.

Yields.

In Malaya, there are two main crops per annum, the first in May and June and the second in November and December, but the plantations are producing fruit throughout the year. During the first year of fruiting the plant will produce one fruit, but in subsequent years, two fruits per plant are usually obtained. The average annual yield is between 4,000 and 5,000 fruits per acre per annum.

Although there is fruit being obtained throughout the year, the main Hawaiian harvest, June to August produces the heaviest crops, with a second crop in December to February. When the first crop is obtained—one fruit per plant—all suckers, with the exception of two, are removed; as a rule, no further removal of ratoon are made unless they are required for planting purposes. The Hawaiian plantations, by reason of close planting, the application of manures and cultivation, produce heavier crops than are obtained in Malaya. In South Africa, the annual crop is estimated at between 6,000 and 10,000 fruits. Although the yields of pineapples from Malaya are small, it must be remembered that the capital invested is also smaller than with other countries, and that the land is planted with a second crop—rubber.

An estimate of the cost of bringing an acre of pineapples into bearing in Hawaii has been stated as follows (Currency, dollars gold).

Clearing $40; Ploughing $25; Plants $56; Planting $10; Weeding and ploughing $27; Fertilising $35; Harvesting $13.50; Collecting $36.—Total $242.50.

It must be understood that subsequent crops will cost very much less; the only fair way of arriving at cost being to average it over a period of not less than four years.

In a subsequent number of *The Malayan Agricultural Journal*, it is proposed to conclude this series of articles on pineapples by a consideration of the subject of Pineapple Canning.

SELECTED ARTICLE.

THE PREPARATION AND WORK OF RURAL SCHOOL TEACHERS IN MALAYA.*

BY

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The Sultan Idris Training College, a large residential College founded and controlled by Government and modelled on the lines of an English public school, trains Malay pupil teachers for service as schoolmasters in the Malay vernacular schools, and forms Malaya's sole source of supply in this respect. The college course is of three years' duration; there are 375 students, 125 to each year, divided into fifteen classes each of twenty-five. The medium of instruction is Malay. The College aims at establishing its own 1st class certificate as a standard equivalent in the vernacular to the Cambridge school certificate in English, and its own 2nd and 3rd class certificates as equivalent to the Cambridge junior local certificate.

The aim of the Malay vernacular schools as defined by the Government in 1920 'is not to turn out a few well-educated youths nor yet numbers of less well-educated boys; rather it is to improve the bulk of the people and to make the son of the fisherman or peasant a more intelligent fisherman or peasant than his father had been, and a man whose education will enable him to understand how his own lot in life fits in with the scheme of life around him'. The great majority of the indigenous population of Malaya is engaged in agriculture, so that it has long been considered necessary for Malayan vernacular education to have an 'agricultural bias'. In the vernacular schools horticulture and at least one other industry are taught, and a pass in one industrial subject required for the certificate that marks the completion of the course. A system of school and home gardens has been adopted, and a scheme approved for European inspectors of agriculture attached to the training colleges as teachers to supervise agriculture. The curriculum of the Sultan Idris Training College for Malay school teachers is designed to carry out this policy.

The College is situated in a rural area, and not near a large town. This is considered important as affecting the mental outlook of the students. We do not desire to do anything to increase the lure which the towns undoubtedly exercise on the youth of all countries and races. The choice of a rural site had

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the additional advantage of enabling Government to acquire a sufficient area of land at a moderate price. The College grounds cover an area of seventy acres of flat land.

School gardening with rural husbandry plays a large part in the curriculum, both theoretical and practical. The method of instruction is that from which the student will derive most benefit and advantage, when he either takes up his post as a schoolmaster, or returns to his own village. In this training, which is extended over the three years of the college course, every effort is made to present the subject to the boys in an attractive and palatable manner. Secondly, it is essential that the practical advantages of work on the soil shall be proved beyond all shadow of doubt—this being the surest road to success. The first year introduces the students to soils in all their complexities and activities. The various methods of soil improvement are fully discussed and practical examples given in the outdoor work. At the same time, the relation of plants to the soil, their elementary structure, their food materials and their means of absorbing such materials are explained as simply as possible. Apart from explaining the cellular construction of plants and discussing their outward form, it has been found better to leave the study of the real botany of the plant until the second year, when the student's mind has to some extent at least been trained to think on scientific lines. Diagrammatic work on the blackboard is largely practised by every student; there is no better way of preparing the student for his future work, and of informing the teacher how much of the lesson has been grasped. A written test of the work done is held every two months.

On the practical side, in the first and second years, each student has an individual plot, divided into three ridges, and for this, subject to the advice and supervision of the staff, he is held entirely responsible. Four mornings per week from 6.30 to 7.30 a.m. and one afternoon from 4.45 to 6 p.m. are devoted to this outdoor work. On each of his three ridges he plants a different crop and as he has at least two crop changes per year, he acquires a general knowledge about the growth and habits of at least six different crops. Each boy has a note-book into which he enters day by day the precice nature of the work done in his plot. At the same time he has a card-index which he fills up from time to time, and so gains some experience in recording work. Plots are inspected monthly, and marks awarded for the condition of the crops grown, tidiness, amount of care expended, etc.

In the second year the individual plot system of outdoor work is continued, but as far as possible a different series of crop is grown. At the same time each student is given one large tree to be under his special care. This may be either a fruit tree or an ornamental tree in the college grounds. He is responsible for keeping that tree in the healthiest possible state, and if he discovers it is diseased he immediately reports the matter to a master or one of the third-year students, who instructs him how best to combat the disease. In the case of a disease so far not described to the students, the whole class is gathered round the diseased tree and a short lecture given. It is found that in

this way the boys gain a fair knowledge of the common trees of their native land, the disease to which they are subject, and the best means of disease prevention and control. At the same time they acquire a keen interest in the upkeep of the college grounds, and unconsciously prepare themselves for further work on these lines during their third year.

On the theoretical side, the term commences with a thorough study of plant physiology and anatomy. Though no laboratory work is possible, each student is supplied with a specimen of the plant or part of the plant about which the lesson is being given. Whenever possible, sections are cut and demonstrated under the microscope to each student in every class. In time it is hoped that the students will be able to undertake a little microscopic work on their own. Later in the term the various methods of plant propagation are studied, and here again practical work plays an important part. The College has its own nurseries for which under European supervision the boys are responsible. Demonstration and actual practice are given in reproduction by layering, suckers, grafting, budding, and cuttings. A study of the best and most up-to-date planting methods for garden crops is made and in turn carried out by the boys in their individual plots. This method of teaching has proved very successful in the College, the crops now under cultivation being of a very high standard indeed. Its introduction into the villages through the medium of the College students who become vernacular school teachers will do much to promote native happiness and prosperity. The term is brought to a close by a study of animals and their relation to plants. The importation of stock, and the inter-breeding of imported with indigenous stock, open up vast and difficult problems best left to Government specialists. This subject is but lightly touched upon in the curriculum. But the problem of animal nutrition, of vital importance in the tropics, receives as much attention as conditions will allow; it is hoped in the near future to demonstrate actual feeding experiments at the College itself.

The third year is essentially a year of application. The students are given actual practice in teaching in the vernacular school which is attached to the College. Then in their outdoor work the individual plot system is dispensed with and various other outdoor activities undertaken. In each year there are five classes, A, B, C, D and E; so five different types of work are allotted and each class undertakes one; every three weeks a change-over is made until finally every third-year student has experience of each type. About one term is necessary to complete the rotation of these duties, and in the second term it is hoped to allot five other schemes of work, so that at the end of the year the students will have had experience of ten different types of work. The scheme at present in use is as follows:

A. Care of orchard, planting of new fruit trees, pruning and manuring where necessary.

B. Care of nurseries and large communal plots. This includes sowing of seed, care of seedlings, transplanting, thinning out, &c. Also practice in care and harvesting of a fairly large variety of crops.

The communal plots include maize, sweet potato, ground-nut, tomato, lettuce, Lima bean, long bean, French bean, &c.

C. Care of the grounds under economic crops. At present this only includes pineapples, tea, bemban, mengkuang, and coffee, but it is hoped to extend the scope in future. This gives considerable practice in disease control and cultivation methods.

D. Supervision of the plots of first and second year students, with advice and help to them where necessary.

E. Ornamental work and care of flowers in college grounds. This includes experience in the laying-out of flower-beds and in the general decoration and improvement of gardens.

We propose to choose next year a few students who exhibit any particular aptitude for gardening work and give them a few simple agricultural experiments to carry out, e.g. spacing experiments, variety yields, &c.

The theory work in class includes a general study of plant and animal pests. At the beginning of the term a thorough study is made as to what is meant by 'disease,' followed by a study of the common practicable methods of disease control and application of these methods to their work in the gardens. Later in the term the major economic crops of Malaya—rubber, coconuts, rice, &c., come under review; here again simple and practical measures alone are adopted and emphasized. Short talks dealing with the economic aspects of agriculture, e.g. marketing, co-operation, and costs of production, are included in the course of study. Finally as the students are being trained for appointment as teachers in vernacular schools, instruction in the special details relating to organization and development of school gardens is given.

When one considers the wonderful improvement in the grounds of the College during the last five years and realizes that it has mainly been brought about by the students themselves it becomes abundantly evident that much can be accomplished where there is discipline and the will to work. The idea is, at present, to try and get each year of students to leave some definite result of their handiwork in the grounds. In the matter of crops grown the high standard attained by the students is demonstrated by the large number of prizes of all classes gained by them at the various agricultural shows throughout the country. When the ex-student has become a teacher in some village school, the practical side of his training at the College serves him in good stead. Often he has a piece of barren ground to plan out and develop into vegetable, fruit and flower gardens. In no case will he ever inherit a piece of ground which is not capable of improvement and development. The good garden work which is being done in schools is evident both in the large number of exhibits and the large number of prizes which these exhibits obtain at shows. This procedure should be encouraged to the fullest extent, as competition always creates healthy activity.

From the comprehensive and practical instructions on the teaching of rural

science issued by the Education Department to all teachers, the following notes are taken:

Every teacher should make a plan of the school gardens, showing improvements and forms of cultivation, e.g. vegetables, fruits, flowers, &c., together with plots of the individual pupils.

In order to facilitate planting and cleaning, vegetable plots should be not more than four feet wide. Each should be numbered and should bear the pupil's name.

Each of the higher forms should have a communal plot to teach the value of co-operative labour.

Every pupil should keep a note-book recording instructions given in gardening, together with the day when the seed was planted, when it sprouted, when it flowered, &c., weight of crops, pests encountered, &c.

One of the elder pupils should be in charge of school gardens under a teacher, and one pupil should be in charge of the work of each standard, another of seeds, another of crops.

The teacher should award marks twice a term both for individual and for communal plots.

Produce of the school crops may be divided among the students responsible and taken to their homes, or they may be sold and the proceeds used for school purchases, e.g. on prizes for gardening or school sports. Careful accounts of expenditure and receipts should be kept.

All teachers must remember that they are expected themselves to work in the gardens, and that class work is only a preparation for gardening work.

The visiting officials of the Education Department regularly inspect the entire work of the school including the practical work in rural husbandry, and marks are allotted for cleanliness and condition of school gardens for which full credit is given in the annual grading scheme.

The co-operation of agricultural officers, as it becomes available, will greatly improve this garden work. Careful regulations, which define the relations between the Agricultural and Education Departments, provide among other things for the scrutiny of all arrangements for the establishment and equipment of school gardens and for their periodic inspection by agricultural field officers, on whom also inspectors of schools rely for the supply of such planting material and seeds to schools in their areas as masters cannot by their own efforts secure. Another subject that is engaging the attention of both Departments is that of encouraging pupils to apply to their home gardens the methods learned at school, and to bring their home difficulties to school for discussion.

I can say with confidence that the introduction of manual training, and particularly of school gardening, has had a profound effect on the attitude of the Malay schoolboy towards manual work of all kinds. I cannot improve on the language used in this connection by the Director of Education: "The old-

fashioned Malay teacher, puffed up with a little learning and full of the old oriental scholar's prejudice against manual labour, was ashamed to dig; he now delights in handicrafts and in practical acquaintance with the rotation of crops, the selection of seeds and the study of pests." The attitude of the new teacher is reflected in the new pupil. The new pupil has begun to realise that his education in the school is a real preparation for life. There can be no doubt of the success of school gardening in the Malay vernacular schools, and in my opinion the two essential factors in that success have been—

(1) the provision of adequate skilled instruction in the Teachers' Training College;

(2) the supervision of the village school gardens provided by the staff of the Agricultural Department. That supervision the newly appointed Director of Agriculture is anxious to extend. Both the Education and the Agricultural Departments realise that co-operation must be real to be effective.

AGRICULTURAL SHOWS, 1930.

Seventh Malayan Exhibition, Kuala Lumpur, April 19th—21st.

Negri Sembilan Agricultural Show, Seremban, July 25th and 26th.

Malacca Agricultural Show, Malacca, July 26th.

Pahang East Agricultural Show, Kuantan, First week in September. Date not yet fixed.

Pahang West Agricultural Show, Temerloh, August or September. Date not yet fixed.

Perak North Agricultural Show, Taiping or Kuala Kangsar, August. Date not yet fixed.

Perak South Agricultural Show, Tanjong Malim, August. Uncertain.

REVIEWS.

The Report of the Agricultural Commission in the Colony and Protectorate of Kenya.

A copy has recently come to hand of the report of the Agricultural Commission of the Colony and Protectorate of Kenya and is a document of considerable interest. The Commission was appointed in September, 1929, the terms of reference being—

1. To consider and make recommendations with regard to the progress of the main branches of the agricultural industry (including native agriculture and stock) since 1920.
2. Factors which tend to retard progress if any and the means whereby production may be increased and accelerated.
3. The provision which should be made for augmenting departmental or other services calculated to advance this industry and the share if any which should be borne by organisations or undertakings representing or concerned with agricultural interests and productions.
4. The formation and functions of advisory, consultative or other bodies in connection with the agricultural industry.

The Chairman of the Commissioners was Sir Daniel Hall; the Report which consists of a document of some 54 pages together with appendices covers a period of work dating from the 12th of September, 1929, to the 29th of October, 1929. The Report itself is dated October 23rd, 1929. It will thus be seen that a remarkable amount of work has been carried out during a comparatively short period. The principal findings of the Commission are contained in a summary of recommendations which is prefixed to the main body of the Report.

The first subject dealt with is the question of the appointment of a Minister of Agriculture, which the unofficial members of the Commission recommended subject to constitutional difficulties being overcome; alternatively, if this recommendation was not found possible, they recommended the establishment of an agricultural board, which latter suggestion was subsequently unanimously endorsed by all members of the Commission. The title of the proposed Board is that of Board of Agriculture and Development. It is proposed that this should be purely an advisory body and that it should deal with all questions connected with agriculture including animal husbandry, veterinary services and veterinary research. It is further recommended that the Conservator of Forests and the Game Warden should attend meetings of the Board from time to time in order to ensure due consideration of the requirements of agriculture in the policy of their respective departments.

In relation to organisation of the Department of Agriculture, the Commission unanimously rejected the proposal for separating the agricultural and

veterinary services and considered that these should continue to form an integral part of the Agricultural Department. They further recommended that a quarterly conference should be held between the various branches of the services which the Governor should initiate and over which he should from time to time preside; on the crop husbandry side the Commission advocated a formal conference once a year between the Agricultural Officers and the members of the Research Services.

The Commission put forward various suggestions for the extension of agricultural services including institution of a plant breeding section of the Department, appointment of Agricultural Economists, the institution of an Engineering Branch of the Department pertaining to machinery, and the improvement and extension of methods of disseminating information. It also discussed the question of the appointment of agricultural officers specialising in education, but did not consider that the Agricultural Department should set up a branch for advising on land or for surveying and reporting on land.

In relation to agricultural problems generally, the Commission considered that there is a pressing need for further credit facilities in the Colony and recommended the Government to institute special inquiry into this question.

In relation to the livestock industry, the Commission considered that while the necessity existed for building up a scheme of mixed farming, the realisation of this project could only proceed slowly on account of the problem of disease among livestock. It expressed doubt whether existing quarantine regulations can be successfully enforced and recommended that new regulations should receive consideration. It also considered the question of an Experimental Stock Farm and if such a project is approved, indicated that the scheme has three objects:

1. The building up of an improved native herd by selection within the local breeds of cattle, coupled with experiments on grading up by the use of Indian and Africander sires.
2. The maintenance of a dairy herd kept entirely indoor on the soiling system.
3. The creation of paddocks of improved grasses.

The Commission recommended the institution of certain experimental farms, particularly one in the coastal area, with the object of encouraging development. It also dealt with the need for some educational assistance to the Indian cultivators in the Nyanza Province, and discussed questions of closer settlement of land, the possibility of introduction of British agricultural skilled labour and stressed the necessity for maintaining an agricultural atmosphere in the native schools so as to avoid the tendency to turn out clerks or odd-job men instead of artisans and agriculturists. It further considered that the fisheries should come within the control of the Department of Agriculture.

The question of the formation of special research stations in relation to particular industries was also considered and the opinion expressed that such research organisations are indicated in the case of the coffee and the sisal in-

dustries. The principle of the schemes put forward by the Coffee Planters' Union and the Sisal Growers' Association was generally approved.

A considerable section of the report is devoted to discussion of native agriculture with special reference to the characteristics and customs of the different native tribes which inhabit various parts of the Colony. Each of these tribes has its own particular set of conditions and requires to receive different treatment in relation to agricultural policy.

In general, the point is stressed that improvement of native agriculture is closely bound up with the general problem of raising the physical health and the education of the natives and that it follows therefore that an advance in native agriculture as in other respects is but a part of the work of administrative officers. The Report stresses the need for the unification of services to the extent that agricultural officers should be seconded for service in native reserves and attached as advisers to Provincial Commissioners, advising District Officers in regard to agriculture and leaving the execution to them.

The question of the improvement of agricultural conditions throughout the British tropics is one of high importance; in all tropical regions increasing attention is being devoted to such questions by the official and unofficial representatives of the communities; as a comprehensive idea of the conditions and requirements in the various tropical regions as a whole can undoubtedly prove of great assistance in solving difficulties and establishing a policy in any particular region, the report may be commended to the careful study of all those who have to deal with questions of this description in Malaya.

H. A. T.

Seedling Fruit Stocks.

BY

H. B. Tukey. Bulletin No. 569 April, 1929, New York State Agricultural Experimental Station, Geneva, N. Y. Published by the Station Under Authority of Cornell University.

In this bulletin, a very lucid account is given of the methods employed by American nurserymen in raising fruit seedlings as stocks for budding and grafting. In the past, the supply of root stocks has been largely met by importation from Europe, but owing to the embargo on imported stocks which comes into force on June 30, 1930, American growers are now giving the matter considerable attention.

The majority of fruit tree stocks employed in America at the present time are seedling stocks. Investigations are centered upon the production of stocks from superior clones with the object of obtaining greater uniformity in orchards. When stocks are propagated vegetatively, uniformity of type is readily secured, but in the case of seedlings, which the nursery trade is dependent upon, considerable difficulties are encountered.

It is not necessary here to recapitulate the information advanced regarding the various stocks recommended for the temperate fruits under consideration, namely, apple, pear, plum, cherry and peach, as such information has no local

interest. In the tropics, where climatic conditions are almost constant, such matters as time of planting, period of after-ripening i.e., the period between removal of the seed from the fruit to sowing, do not arise. On the other hand, the principal of growing desirable forms of fruits on robust stocks, as practised in temperate countries, is considered to be a necessary concomitant to the improvement and culture of Malayan fruits.

In New York State, two types of seedling trees are grown, those with straight roots for grafting and others with branch roots for budding. The seeds are usually sown in drills 36 inches apart so as to allow surface cultivation with horse labour. Such cultivation is undertaken with the object of preventing the formation of a crust on the soil.

Transplanting may take place after the first or second years growth according to circumstances. Three methods are used in this operation, namely, dibbling the seedlings into the soil by hand, the use of transplanting boards, and automatic transplanting machines. The first method is satisfactory when care is taken in planting, but American labour objects to the drudgery entailed by such work. The best results are obtained by the use of the planting board. Several types of planting boards are used; that commonly employed being 3 feet long with notches $\frac{1}{4}$ inch deep and 3/16 in. wide, the notches being $1\frac{1}{2}$ inches apart. The seedlings are kept in place by an elastic band drawn across the front of the board. Three such boards capable of holding a total of 75 seedlings are held together in a frame. The seedlings are placed straight against the sides of the trench and the soil pressed firmly round their roots. The board is then removed, leaving the young plants properly spaced and with their roots in a vertical position. Transplanting machines are in use, but are not considered sufficiently advanced as yet to be practical. One type of machine, however, fitted with a special feeding attachment, and capable of being drawn by a tractor, has been used successfully. This machine, worked by two men, is able to plant 30,000 seedlings in a day.

It will be seen that the raising of seedling fruit stocks is an important undertaking in America. The question may well be asked; can such methods be employed profitably with tropical fruits in Malaya? In the opinion of the reviewer of the bulletin under consideration, the answer is a decided, yes. Taking four fruits commonly grown in the Malay Peninsula, namely, mangosteen (*Garcinia Mongostana*), duku (*Lansium domesticum* var. duku), rambutan (*Nephelium lappaceum*), and pulasan (*Nephelium mutabile*); all these fruits are readily propagated by budding on to seedling stocks. Whether these fruits are capable of being budded into seedlings of allied species is unproved but not improbable. Ridley (*Flora Mal. Pen.* 1922) records some three dozen *Garcinia* spp. as being indigenous to Malaya. Likewise *Lansium*, two species; and *Nephelium*, thirteen species. An investigation into the possibilities of these and other wild trees as stocks for the cultivated forms might provide useful results. The subject, however, is a large one requiring much time and work before practical results may be forthcoming. J. N. M.

FROM THE DISTRICTS.

The Weather.

Throughout April the weather generally continued hot and rather dry though there were thunderstorms and heavy showers of rain which were somewhat local and varied considerably in number in different districts. Thus, while Singapore, Malacca, Selangor, the country along the main range generally and Western Pahang received an adequate rainfall, the prevailing drought was only partly modified by showers in Penang and Province Wellesley, parts of Perak and of Negri Sembilan and on the east coast of Pahang.

Remarks on Crops.

Rubber.—In Penang and Province Wellesley, many small holders have stopped tapping on account of the low price of rubber, being unable to pay tappers' wages. In the majority of cases tappers' wages have had to be reduced.

The only disease calling for comment is secondary leaf fall caused by the fungus *Oidium Heveae*. This was found to be fairly generally prevalent in Selangor, Negri Sembilan and Malacca on flowers and young foliage developing after wintering. The actual damage done to the trees was, however, not very serious.

Padi.—Padi harvest had been completed very nearly everywhere by the end of the month. The yields in Kedah and in Province Wellesley were poor as had been anticipated, while the padi planted in the mukims of Semanggol and Selensing in Krian and in certain parts of Larut District produced practically no crop.

Nurseries were being planted in Pahang. In Pekan District, the nurseries suffered badly from drought and had to be re-sown. In parts of Negri Sembilan and Malacca, water ways were being cleaned and repaired and the land cultivated for the coming season's crop.

Coconuts.—The exports of copra from Johore for the first quarter of 1930 amounted to 116,177 pikuls being an increase of 12,000 pikuls on the figures for the first quarter of 1929.

In Singapore Island, the caterpiller pest *Artona catoxantha* disappeared from palms in the three infected localities after the advent of heavy rains. In the South Eastern District of the Island, beetles are doing considerable damage and general conditions of sanitation and cultivation call for special attention. The nettle caterpillar *Setoria nitens* has for the time being ceased to be in evidence in Lower Perak District. A number of trees in Province Wellesley were struck by lightning.

The picking of unripe nuts for copra production is a noticeable fault in most coconut areas in Johore. This matter is being given attention. An abnormal

increase in the number of nuts required to make a pikul of copra has been experienced on estates in Bagan Datoh District and is attributed to the severe drought in 1929.

Tapioca.—Production of tapioca has been well maintained in Johore, exports for the first quarter of 1930 showing an increase of about 10,000 pikuls as compared with those for the corresponding quarter of 1929. A few factories in the north of the State were unable to operate in the first half of the month owing to shortage of water.

Areca Nuts.—Exports from Johore for the first quarter of 1930 amounted to 75,839 pikuls, a decrease of about 5,000 pikuls on the exports for the corresponding quarter of 1929.

Pineapples.—Factories in Singapore continued working during the month although the main crop is not expected to come in until the middle or end of May. Prices paid for fruit ranged from $1.30 to $2.80 per hundred. The prices received for canned pineapples varied from $3.45 to $3.80 per case of 48 tins according to type and grade of produce.

Exports of preserved pineapples from Johore continued to increase although prices were very low. During the first quarter about 5,370,000 fruits and 351,842 cases of preserved pineapples were exported, this represents an increase of 70,000 cases over the exports for the first quarter of 1929.

A new factory at Sungei Choh is now operating in Johore. A further area of about 3,000 acres of land has been alienated for the exclusive cultivation of pineapples and fruit trees.

Fruit.—A moderate crop of perennial fruits was observed on the east coast of Pahang.

Food Crops.—In Kedah, land has been cleared and planted with maize to supplement the food supply in certain districts. Dry padi will also be planted when the weather permits.

In western Pahang, further areas of maize and tapioca were planted during the month in the areas near the river, with the result that the actual area of food-stuffs appears to be considerably greater this year than in the past few years. Crops of maize are doing well in the bed of the Pahang river in the east of the State, but drought has affected the growth of vegetables.

Notes on Demonstration Stations and Padi Test Plots.

Kuala Kangsar Demonstration Station.—Sales of produce from this station included 18,000 oranges at $1.50 per hundred, 50 coconuts at $3 per hundred and 148 ducks eggs at $3 per hundred.

Further incubation trials clearly indicate that very fresh eggs are necessary for successful hatching and past failures are undoubtedly due to the use of the stale eggs for incubation.

Seremban Demonstration Plot.—Seedlings of clove, nutmeg and rambutan, pepper cuttings, budded citrus plants, soya bean No. 13 and lesser yam No. 288 have been among the plants distributed from this station. The wet weather

following the drought has caused many of the orange fruits to split. Paper covers have proved an efficient protection to oranges against the attacks of fruit flys.

Kuala Lipis Demonstration Station.—The tapioca varieties recently planted have made very uneven growth, probably owing to the dry weather after planting. Two varieties of maize and one of groundnut together with red gourd were planted during the month. Considerable amounts of banana suckers of several varieties will soon be available for distribution.

Pekan Demonstration Station.—Plants distributed during the month included tomatoes, yams, maize seed, chili seed and seeds of various vegetables. A cicadid pest caused considerable damage to a number of plants. Control measures undertaken after reference to the Government Entomologist have proved fairly successful.

Kuang Padi Test Plot.—At this plot in Selangor the following yields were obtained.

Seraup Besar	No. 48	...	480 gantangs per acre.
Radin	No. 2	...	440 ,, ,,
Local Padi Suta		...	400 ,, ,,

Dong and Temerloh Padi Test Plots.—On both these plots nurseries were sown during the month.

School Gardens.

During the month, progress has been made with the preparation of the beds for replanting after the long holidays. Planting materials have been distributed and the requirements for new tools and for manures have been ascertained. Demonstrations of good methods of cultivation have also been given.

Lecture at Tapah.

Early in the month, a lecture on plant propagation was prepared by the Agricultural Field Officer, Perak South and delivered by the Senior Agricultural Assistant, Batang Padang, at the mosque at Tapah after Friday prayers. This was followed by a demonstration by the Agricultural Field Officer of budding, grafting, layering, marcotting and cutting. About 80 Malays attended and appeared to be highly interested.

Rats.

In Province Wellesley, 116,522 rats were accounted for during the month and 11,851 poison balls were distributed. In Krian, 48,944 rats were destroyed.

In Malacca, Tamil coolies have accounted for a large number of rats by opening up holes in the bunds. Particular attention is being paid to the clearing up of bush and other growth which provides cover for rats.

A number of rat traps have been distributed in parts of Pahang.

DEPARTMENTAL NOTES.

The Seventh Malayan Exhibition, 1930.

In order to convey information to the planting community concerning some of the important lines of work which were being carried on by the Department in connection with local crops, soils, pests and diseases, a comprehensive series of exhibits was staged at the Exhibition held in Kuala Lumpur on April 19th to 21st last.

The building used by the Department was 60 feet long and 36 feet wide, with a large central raised platform. Two small booths occupied one end of the room, whilst the other three sides were flanked with suitable benches. The whole was tastefully decorated and adequately lighted. On the central platform oil-palm and oil-palm products were staged. The two small booths were devoted to padi and coconut insects and publications, respectively. The benches were filled and arranged with exhibits of soils, padi and rice, tea, sisal, tuba, yams, coconuts and copra, rats, diseases of coconuts and oil-palms.

Oil-Palm.—The Agricultural Division's large exhibit illustrated oil-palm culture in its different stages. It comprised seedlings in sand-beds, seedlings ready for planting out in the field, male and female flowers, ripe fruit on bunches, loose fruit, seed, kernels, etc. The Chemical Division co-operated in staging this exhibit and showed the relative proportions of oil, kernels, shell and pericarp residue in oil-palm bunches; sections of fruit showing the sources of pericarp and kernel oils, pericarp oil in various natural colours; an illuminated 'waterfall' of palm-kernel oil, semi-bleached (butter-coloured) and fully bleached palm-oil. Demonstrations were given daily of the use of the bleached natural palm-oil for frying purposes, and the method of determining the percentage of free fatty acid in palm-oil in factories.

Miscellaneous Crops.—Besides the oil-palm exhibit, the Agricultural Division staged an instructive collection of useful crops from the Government Experimental Plantation, Serdang; these included tea, sugar palm, sisal, tuba and yams.

Padi and Rice.—This section was arranged by the Botanical Division and demonstrated more particularly how large increases in yield of grain are obtained by growing selected high-yielding strains of local padi. A collection of the best varieties of padi so far isolated and multiplied was staged in ear-form and as padi and rice. Leaflets describing the advantages to be derived by growing the pedigree seed were distributed. Numerous photographs of the rice selection work carried on in the Titi Serong Experiment Station were shown, together with large graphs illustrating the annual ratios of production to consumption and imports in Malaya. It was pointed out that only 25% of the rice

requirements of the population was now produced locally and that one of the means by which production could be increased considerably was by planting selected seed.

Coconuts and Copra.—In this section, which was arranged by the Assistant Chemist for Copra Research, a special feature was made of exhibits of copra illustrating certain common defects in the local product, the means by which these faults are brought about and how they can be avoided. Deterioration in quality and oil content, as well as of yield, were shown to be due—among other things—to picking under-ripe nuts, using those over-ripe, storage under wet conditions, insect attack, and burning during artificial drying.

Numerous analyses of the samples were given which indicated the extent of the depreciation in the quality of the copra. Exhibits of first class copra, together with their analyses, were displayed in order that they might be compared with the inferior ones. A large collection of coconut products, photographs of the coconut industry and diagram illustrating the variation in yield of individual tall palms on local plantations were also staged.

Soil Exhibit.—This was staged by the Soils Division to demonstrate the different types of soil which occur in Malaya.

Eight commonly occurring soils were shown, namely, quartzite valley, granite, Raub high-level, Raub low-level, dolerite, peat and coastal alluvium, as they occur in the field.

By means of a chart, the significance of differing mechanical compositions was indicated, together with the nomenclature of the different sized particles of which a soil may be composed.

The mechanical composition of the soils exhibited (at the surface and at a depth of 30 inches) was shown by means of a series of tubes, which actually contained the particles of which the soils were composed, sorted out into their different sizes; the numerical percentage of clay, silt, etc. being shown on cards placed beside the tubes.

The general properties of the different soils were defined by a series of small descriptive cards.

The different specimens were linked to a geological map by means of streamers thus showing where in Malaya these various soils are to be expected.

Insect Pests of Padi and Coconuts.—The Entomological Division concentrated its attention on the insects of coconuts and padi.

The insects of coconuts were mostly alive and specimens of the rhinoceros and red-stripe beetles with their grubs together with the nettle caterpillars (*Setora nitens* and *Parasa lepida*) were displayed. An unique exhibit was that depicting the insects which are found on the inflorescences of coconuts—the chief being the greater coconut spike moth (*Tirathaba tufivena*). Examples of spikes showing the damage to the male and female flowers by the caterpillars of this moth were shown and descriptive labels stated that by the removal of the sheath the damage done to female flowers by this moth was practically negligible. It was not claimed, however, that if the enveloping sheath were removed just

before the spike would burst naturally, all female flowers would eventually reach maturity.

Most of the principal pests of padi were shown. Of special interest were the demonstrations explaining the breeding of a parasite which lays its eggs on the eggs of the two principal caterpillar borers of padi. Cages containing rice and bran in which a common grain moth is bred in order to obtain eggs in which this parasite lays its eggs were on view. The moths were then collected by a magnum vacuum cleaner specially adapted for the purpose. The method employed in gumming the eggs of the moth on cards which were eventually placed in tubes containing the parasites was demonstrated. It was explained that cards containing parasitised eggs were sent daily to the Krian district, and fixed to padi plants in the hope that the emerging parasites would parasitise the eggs of the two principal moth-borers, thereby controlling them. This exhibit created considerable interest.

It was stated that more than 3,000,000 parasites had been liberated on three experimental areas in the Krian in the months of January, February and March, 1930.

An excellent series of paintings of coconuts and padi insects was also shown.

Rat Pest.—In order to demonstrate and supply information regarding the best methods of controlling rats, the Field Division staged exhibits of rat-traps and poison-baits and a collection of photographs illustrating the results of rat-drives, trapping and poisoning. The preparation of poison baits was also demonstrated throughout the period of the exhibition and a leaflet describing the various means by which rats could be destroyed was freely distributed.

Other exhibits of interest were live rats in cages with growing padi and oil-palm fruits to show the extensive nature of the damage done by the rodents to these and other local crops.

Diseases of Oil-Palms, Coconuts and Tea.—The Mycological Division devoted particular attention to certain diseases of the stem and fruits of oil-palms, which diseases were causing a considerable amount of damage in plantations. Specimens of the stem-rot and the species of fungi which were possible causes of the disease were displayed, as well as harmless species. The fruit diseases due to *Marasmius palmivorus* was shown on non-pollinated bunches and unripe pollinated bunches and on leaf-stalks.

The effect of lightning-strike on coconut palms was illustrated by means of photographs and a section of a struck palm showing the rotted bud.

The fungus *Marasimius palmivorus* was again shown attacking the leaf-stalks of the coconut palm. Coloured drawing of the principal leaf diseases of tea so far discovered locally were exhibited as well as mounted specimens of diseased leaves

Each exhibit was described fully on large labels which also gave information concerning the methods of controlling the diseases.

Demonstrations.—Besides the daily demonstrations given to the general public in connection with certain exhibits, special demonstrations were given

to a large number of delegates and local headmen from different parts of Malaya who were attending a conference of the Rural Co-operative Credit Societies.

In addition, the Government Stock Farm, Serdang exhibited in the Pig Show one Large Black boar, one Large Black sow, one Middle White boar, one Middle White sow and two young Middle White pigs.

Publications.—A complete series of publications of the Department was displayed for sale and a leaflet distributed containing full information on publications. The Department's publications are in three languages—English, Malay and Chinese. Officers conversant with these languages were in attendance daily to give information to visitors.

The Director of Agriculture Visits Kelantan.

The Director of Agriculture was on tour in the State of Kelantan from the 7th to 12th April. On April 9th, he addressed a meeting of the Kelantan Branch of the Incorporated Society of Planters at Kuala Krai on the subjects of the Agricultural Services in Kelantan and the work of the Rubber Research Institute of Malaya in relation to rubber problems in Kelantan.

Visit of Mr. E. A. Curtler to India and Ceylon.

Mr. E. A. Curtler, Assistant Agriculturist, left Malaya on 19th April, 1930 for Ceylon and India for the purpose of studying tea cultivation as practised in those countries. Mr. Curtler's tour will extend over six months, of which about six weeks will be spent in Ceylon, two to three weeks in Southern India, and the remainder of the time in Assam. He will also give some attention to the cultivation of Arabian coffee in Mysore and will probably visit the hill Station at Ootacamund.

The Agricultural Chemist Visits New York.

Major C. D. V. George, O.B.E., Agricultural Chemist, visited New York in January, mainly to investigate questions relating to Jelutong, on the invitation of Americans interested in this product of Malaya.

Headquarters of the Agricultural Field Officer, Perak South.

The headquarters of the Agricultural Field Officer, Perak South, was transferred from Batu Gajah to Tapah on 1st April, 1930.

Leave.

Mr. G. E. Mann, M.C., Agricultural Instructor (Malay Officers) has been granted eight months and fifteen days leave on full pay, with effect from 2nd May, 1930 inclusive.

Mr. Mann will attend, as a delegate of this Government, the Imperial Entomological Conference to be held in London in June and the Agricultural Congress in Antwerp in July. He will also be on duty at the International Exhibition, Antwerp for one month during his leave.

Conference of Co-operative Society Delegates.

A conference of Co-operative Society delegates—office bearers in Societies and local headmen—was held at The Malayan Exhibition. His Highness, The Sultan of Selangor opened the conference on Saturday, April 19th. His Highness was followed by the British Advisers of Kedah and Kelantan who addressed the conference in the Malay language. Among those present were the Director of Agriculture, the Director of Co-operation and the Under Secretary to Government.

On Sunday and Monday, parties were conducted through the exhibits staged by the Department of Agriculture and the Rubber Research Institute of Malaya, short lectures in the vernacular being delivered at the various stands by the departmental officers.

The final meeting of the conference was held on Monday at which certain resolutions concerning padi cultivation and other subjects were discussed and adopted.

MARKET PRICES.

April, 1930.

Rubber.—Rubber was quoted at $7^{9}/_{16}$ d., London and $25\frac{3}{4}$ cents Singapore per lb., at the beginning of the month. It shewed a slight but steady decline throughout the month, quotations on the last day being $6^{15}/_{16}$ d., London and 23 cents Singapore. The average price for the month was 7.3 pence per lb., London and 24.68 cents per lb., Singapore, compared with 7.6 pence and 25.43 cents for the month of March.

Copra.—Copra prices recovered somewhat, closing around $8.80 per picul F.M., and $9.30 S.D. The average prices for the month were F.M., $8.70\frac{1}{2}$ per picul, S.D., $9.17\frac{1}{2}$ per picul against $8.54 and $8.90 respectively in the previous month. The Singapore Chamber of Commerce records transactions amounting to 3,369 tons for the period 24th March to 19th April.

Gambier.—Average Singapore prices for April, block $8.76\frac{1}{2}$, cube $18.00 against $8.97 and $15.71 per picul respectively in March. Transactions, 64 tons block, 10 tons cube.

Nutmegs.—Average Singapore prices for April: 110 per lb. $34.00 per picul against $35.50 in March; 80 per lb. $37.65 per picul compared with $38.75 for the previous month.

Pepper.—Singapore prices averaged $45.00 per picul compared with $47.31 for black, $55.06 against $67.34 for White Sarawak. Transactions, 49 tons black; 140 tons white.

Rice.—Singapore average price; Siam, $365.75; Saigon, white, $262.75; Rangoon, white, $244.25—all per coyan. Corresponding average prices in March were $339.50; $247.00; $222.00. It will be seen, therefore that the price of all grades appreciated in price. The average prices in February were —Siam $384.00; Saigon $253.80, Rangoon $239.60.

Sago.—Average Singapore prices for April were as follows:—Pearl, fair, $6.50\frac{1}{2}$ (27 tons); Flour, $5.96 (1,821 tons) per picul, compared with $7.03 and $3.92 per picul in March.

Tapioca.—Average prices in Singapore; Flake, small, fair $5.32\frac{1}{2}$ (330 tons) against $5.57 per picul in March; Pearl, fair $7.00 per picul (130 tons) compared with $7.47 per picul in March.

The above prices are based on the daily cabled London quotations for rubber and on the Singapore Chamber of Commerce Market Reports covering the period 24th March to 19th April, 1930, and on other local sources of information. The quantities in brackets are the transactions recorded by the Singapore Chamber of Commerce.

1 coyan = 40 piculs 1 picul = $133^{1}/_{3}$ lbs.

The dollar has been fixed at 2 shillings and 4 pence

MALAYA RUBBER STATISTICS.

STOCKS OF RUBBER INCLUDING LATEX AND REVERTEX HELD BY DEALERS AND ESTATES OF 100 ACRES AND OVER, TOGETHER WITH THE DECLARED PRODUCTION OF THE SAME ESTATES, IMPORT AND EXPORT FIGURES, AND ESTIMATED FIGURES OF THE PRODUCTION OF ESTATES OF LESS THAN 100 ACRES, FOR THE MONTH OF MARCH, 1930, IN DRY TONS.

Territory	Stocks at beginning of month			Production by estates of 100 acres and over		Production by estates of less than 100 acres (estimated)		Imports				Exports (including re-exports)				Stocks at end of month		
								during the month		during the year 1930		during the month		during the year 1930				
	Ports	Dealers	Estates of 100 acres and over	during the month	during the year 1930	during the month	during the year 1930	Foreign	From Malay States	Foreign	From Malay States	Foreign	Local	Foreign	Local	Dealers	Estates of 100 acres and over	Ports
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
MALAY STATES																		
Federated Malay States	...	11,941	14,338	10,926	35,603	8,271	31,091	Nil	2	Nil	18	15,356	5,354	50,623	18,035	11,730	13,038	
Johore	..	2,379	5,040	3,310	10,673	3,347	12,398	Nil	3	Nil	3	1,226	6,222	3,158	21,232	2,151	4,480	
Kedah	...	359	1,878	1,727	5,673	1,182	4,267	Nil	Nil	2	Nil	659	2,206	2,243	8,171	420	1,863	
Perlis	..	28	9	8	26	19	53	Nil	Nil	Nil	Nil	Nil	27	Nil	74	28	9	
Kelantan	...	271	119	120	651	590	1,229	4	Nil	13	Nil	84	652	219	2,009	210	158	
Trengganu ...	...	...	...	...	...	...	...	Nil	Nil	Nil	Nil	Nil	236	Nil	581	...	...	
STRAITS SETTLEMENTS																		
Malacca	...	2,505	1,649	1,189	3,835	1195	7694	Nil	988	Nil	3,195	3,373	Nil	12,120	Nil	2,179	1,666	
Province Wellesley	...	143	638	392	1,466											159	505	
Dindings	...	94	147	90	290			745	3,095	2,631	10,878	5,949		18,577		123	134	
Penang	1,859	5,377	7	8	29											5,305	8	1,404
Singapore	4,962	31,214	410	226	743			9,804	10,610	28,736	36,016	20,801		62,279		31,734	345	3,662

ANALYSIS OF COLONY AND FEDERATED MALAY STATES DEALERS' STOCKS AT END OF MONTH, IN DRY TONS.

Class of Rubber	Federated Malay States	Singapore	Penang	Province Wellesley, Dindings and Malacca	Johore	Gross total
(20)	(21)	(22)	(23)	(24)	(25)	(26)
Smoked sheet ...	8,828	12,155	3,453	1,365	999	26,800
Crepe	676	16,244	1,009	779	226	18,934
Unsmoked sheet ...	1,019	3,335	843	317	926	7,647
Scrap and lump ...	1,207					
Total all Grades ...	11,730	31,734	5,305	2,461	2,151	53,381

Notes.—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month; i.e., Column (7) = Columns (13) + (14) + (17) + (18) + (19) — (2) — (3) — (4) — (5) — (9) — (10).

3. Colony Dealers' Stocks are as published in Return I. & E. 6, dated April 10. The ratio of the reduction on wet rubber, taken from dealers' returns, is 27.9% for Singapore and 24.9% for Penang.

4. Malay States Dealers' Stocks are reduced by the following fixed ratios: Unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%.

5. Foreign imports are as published in Return I. & E. 5, dated April 4, reduced to dry weight by the percentages in Note 3 (*S.S. Gazette* Notification No. 712 1930).

6. Foreign exports are those of each State and Settlement as published in the Malaya Monthly Trade Return (Appendix II), and are distinct from Ocean-Shipments as published in Return I. & E. 4, dated April 5.

7. The State of Trengganu has no organisation at present for the collection of returns of stocks and production; the latter can be estimated as equivalent to exports.

8. All statements are brought up to date monthly and any inaccuracies that may be disclosed are corrected in the totals. The latest publication is therefore always the most reliable.

KUALA LUMPUR,
March, 1930.

JNO GORDON-CARRIE,
Deputy Registrar-General of Statistics, S.S. and F.M.S.

Summary of Padi Report for the Month of February, 1930. (F.M.S. and S.S.)

State.	Locality	Acreage of Padi Land			Acreage planted current season			Remarks.
		Acres	R.	P.	Acres	R.	P.	
S.S.	P. Wellesley -	39,640	0	00	38,120	0	00	Age 4 months from date of planting.
	Penang -	4,000	0	00	2,842	0	00	Age 4 to 5 months. Harvesting Progress. Irrigation available to limited area. Lot of damage by rats and stem borer. Scattered areas about 500 acres not included
	Malacca -	35,279	0	00	29,734	0	00	Harvesting about completed Prospects are good.
	Total:—S.S.	78,919	0	00	70,696	0	00	
Perak	North -	82,918	0	00	75,887	0	00	Except Bruas District all other districts are very fair Age 4-5 months from date of planting. About 12,807 acres harvest nearly finished, rest progessing.
	South -	*			†2,930	0	00	Crop prospect at present very fair. Padi secured in excellent condition as a result of dry weather.
	Total:—Perak	82,918	0	00	78,817	0	00	
N. Sembilan	Six Districts -	37,217	0	15	31,405	2	17	Prospects good. Dry padi 345 acres. Estimated output about 19603 acres @ 250 gantangs per acre and rest @ 200 g. p. a.
Pahang	West -	20,089	0	00	4,079	0	00	Raub District. Harvest completed. Total area harvested 4079 acres. Crop harvested Total **1,007,837** gantangs. Remaining areas of Temerloh, Lipis and Bentong Districts off season. Raub District: Dry Padi 120 acres planted and has given estimated yield of 22,600 gantangs.
	East -	*			*			
Selangor	Five Districts -	22,692	0	00	19,687	0	00	Scattered areas in 5 districts = 2500 acres crop harvested on same 61,375 gantangs. Prospects Ulu Langat and Kuala Lumpur districts are fair. Total yield in so far completed areas of the 5 Districts amounting to 1,635,925 gantangs.

Notes.—* Not ascertained.

† 5,750 acres Dry Padi not included.

Summary of Padi Report for the Month of March, 1930.

State.	Locality.	Acreage of Padi Land.			Acreage Planted current Season.			Remarks.
		Acre.	R.	P.	Acre.	R.	P.	
S.S.	Malacca -	35,299	0	00	29,739	0	00	Harvesting completed about 26,293 acres in Alor Gajah, Jasin Coast Mukims, and Central Districts. Prospects of crop on Jasin Central Districts Good. Yield on 14,713 acres =**5,372,940** Gantangs.
	Prov: Wellesley-	39,640	0	00	38,120	0	00	North and central parts harvesting almost completed. Prospects of crop on these blocks are poor, owing drought during growing period and generally unfavourable weather conditions. Southern part 350 acres Harvesting completed. Very fair Crop. Yield about 450 gantangs per acre about 3900 acres late rains delayed planting, insufficient water, ¼ area will give practically no crop. Total yields so far harvested Pro: Wellesley .. **6,216,500** Gantangs. Scattered area .. 500 acres Yield **45,000** Gantangs. Dry Padi .. **350** acres: Crop below average.
	Penang -	4,000	0	00	2,842	0	00	Harvesting completed. Fair crop. Irrigation available but to limited area. Rats and stem borer caused lot of damage. Total yield ... **1,201,500** Gantangs.
	Total, S.S. -	78,939	0	00	70,701	0	00	Total Yields S.S. (Including Dry and Scattered areas,) .. **12,835,940** Gantangs.
Perak.	North -	82,917	0	00	75,887	0	00	Perak North:—Kuala Kurau, crop not up to expectations. Very fair crop reaped in Bagan Tiang, Tanjong Piandang, and Bagan Serai Mukims, Parit Buntar prospects fair. Briah, Selinsing, and Gunong Semanggol late and prospects poor. Larut prospects not good except in Selama and in Batu Kurau. Good average crop reaped in Kuala Kangsar. Upper Perak yield below expectation, and many empty glumes.
	South -	*			2,930	0	00	Areas of Dry Padi 261 Acres:— Perak South. All are scattered areas except 1198 Acres in up River Mukims. Harvesting completed in Taja, Ulu Kinta and Tapah Districts. Total yield in these 3 Districts. = **135,358** Gantangs. Rest of the areas Harvesting progress and commencing. Total Dry Padi =**5,750** acres of which 1,708 acres in Tapah yielded **295,147** Gantangs.
	Total, Perak -	82,917	0	00	78,817	0	00	

* Not known.

State.	Locality.	Acreage of Padi Land.			Acreage Planted current Season.			Remarks.
		Acre.	R.	P.	Acre.	R.	P.	
N.S.	Six Districts -	37,217	0	05	31,405	2	17	Harvesting completed in all Districts. Total yield Harvested in N.S = **8,149,670** Gantangs.
Selangor.	Six Districts -	22,692	0	00	19,687	0	00	Harvesting completed in Ulu Langat, Kuala Lumpur and Ulu Selangor Districts in February. About 13,000 acres in Kuala Selangor Harvesting commenced. Scattered areas 2,520 acres. Yield on 945 acres = **61,375** Gantangs. Damage by Pests and lack of water in the areas north of Selangor River indicates a poor harvest in K. Selangor District.
	Total, Selangor-	22,692	0	00	19,687	0	00	
Pahang.	West -	12,311	0	00	...	...	...	Temerloh District 12,311 acres established nurseries. Lipis, Raub and Bentong off Season.
	East* -							* Returns by Quarterly.
	Perak -	82,917	0	00	78,817	0	00	
	Selangor -	22,692	0	00	19,687	0	00	
	Negri Sembilan-	37,217	0	00	31,405	2	17	
	Pahang -	...	...	...	...	...	...	
	Total, F.M.S. -	142,826	0	00	129,909	2	17	
	Total, S.S -	78,939	0	00	70,701	0	00	

METEOROLOGICAL SUMMARY, MALAYA.

MARCH, 1930.

Locality	Air Temperature in degrees Fahrenheit										Earth Temperature		Rainfall				Number of Days						Bright Sunshine		
	Means of			Absolute Extremes									Total		Most in a day										
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Date	Lowest Min.	Date	Lowest Max.	Date	Highest Min.	Date	At 1 foot	At 4 feet			Amt.	Date	Precipitation	Precipitation, 1mm. or more	Thunderstorm	Thunder heard	Fog morning obs.	Gale force 8 or more	Total	Daily Mean	Length of Day
	°F	°F	°F	°F		°F		°F		°F		°F	°F	in.	mm.	in.								hr.	hr.	hr.
Railway Hill, Kuala Lumpur, Selangor ...	93.3	73.4	83.3	97	5, 20	71	24th	88	14th	75	Several	84.2	84.3	6.51	165.4	1.87	12th	14	11	6	14	3		210.30	6.78	
Bukit Jeram, Selangor ...	92.2	73.2	82.7	96	27th	71	27th	89	13, 15	72	,,	88.1	88.8	2.02	51.3	0.48	7th	13	11	...	21	1		259.25	8.36	
Temerloh, Pahang ...	91.4	72.6	82.0	97	5, 29	70	3rd	77	13th	76	6th	85.8	85.8	2.72	69.1	0.90	11th	12	8	2	12	6		193.85	6.25	
Kuala Lipis, Pahang ..	89.5	72.5	81.0	94	5, 29	70	8, 12	76	13th	75	6th	83.1	82.6	4.28	108.7	0.93	7th	14	13	3	12	15		187.65	6.05	
Kuala Pahang, Pahang ...	86.1	77.0	81.5	89	Several	72	14th	75	13th	81	Several	85.3	85.0	12.04	305.8	5.38	13th	16	12	...	2	...		246.00	79.4	
Cameron's Highlands, Rhododendron Hill, Pahang ...	72.8	59.7	66.3	78	4, 5	56	8th	66	9th	61	,,	...	...	4.86	123.5	1.23	23rd	22	20	2	19	1		164.75	5.31	
Cameron's Highlands, Tanah Rata ...	72.9	56.3	64.6	76	20, 21	49	4, 31	68	9th	63	7th	68.7	68.5	4.61	117.1	1.20	23rd	22	18	2	19	1		147.90	4.77	
Fraser's Hill, Pahang ...	72.3	62.3	67.3	77	28, 29	60	8, 12	66	13th	65	6th	71.7	71.5	5.92	150.4	1.57	5th	21	19	4	23	9		138.70	4.47	
Mount Faber, Singapore ...	86.9	73.8	80.3	90	Several	71	10th	78	13, 14	75	Several	81.4	82.5	7.37	187.2	2.27	16th	13	10	...	15	...		211.80	6.83	
Bukit China, Malacca ...	85.1	74.5	79.8	92	1, 30	72	8, 14, 17	82	14th	77	1, 27, 28, 30	83.3	86.8	9.72	246.9	3.21	23rd	15	12	4	12	...		222.55	7.17	11.10
Kluang, Johore ...	89.2	72.7	80.9	93	Several	69	9th	78	10th	75	19, 20	82.8	82.5	3.77	95.8	0.85	11th	14	10	...	9	1		206.40	6.65	
Bukit Lalang, Mersing, Johore ...	84.8	73.5	79.1	87	Several	70	Several	78	10th	79	20, 21	81.2	80.7	8.13	206.5	2.14	...	...	...	...	5	3		234.85	7.58	
Alor Star, Kedah ...	93.2	73.2	83.2	97	1st	69	10, 13	87	14th	76	16th	86.2	86.5	7.06	179.3	1.93	27th	2	11	4	19	..	1	250.40	8.07	
Kota Bharu, Kelantan ...	87.3	72.7	80.0	90	Several	69	4th	83	17th	76	Several	82.3	82.8	5.37	136.4	1.17	16th	14	11	...	2	..		237.65	7.67	
Kuala Trengganu, Trengganu ...	86.4	74.0	80.2	89	6, 7, 31	71	4th	83	18th	79	8th	82.8	83.2	5.98	151.90	1.58	13th	14	10	1	1	6		253.80	8.19	

Compiled from Returns supplied by the Meteorological Branch, Malaya.